

# **Chapter 3 & 4**

## **Affected Environment and Environmental Consequences**

# Changes Between the Draft and Final SEIS

The following changes were made to Chapter 3&4 between the Draft and Final SEIS. Minor corrections, explanations, and edits are not included in this list.

- Based on public comments, many sections were reorganized to provide greater consistency between sections. Although all sections are not organized exactly the same, they do consistently address species stability and distribution and include a comparison of the alternatives. Anticipated effects are described using more consistent language.
- New data was received from field units following summer and fall pre-disturbance surveys. This new information was used in the species review process to re-analyze assignment Survey and Manage species to management categories.
- Based on public comments and internal review, the effects analysis process changed to provide additional clarity and consistency. Among the changes were (1) clear definition of all terms used in the analysis, (2) adoption of standard descriptions of species distribution patterns, (3) adoption of a standard set of outcomes for determining effects, and (4) standardization of the organization of each of the effects sections.
- Based on a number of public comments, current information regarding the number of sites by species has been updated for all species. That information is now included in Tables F-1 and F-2. In the Draft SEIS, number of sites was presented for fungi in Table 3&4-2 and mollusks in Table 3&4-4. Those tables are not reproduced in this Final SEIS.
- The Costs of Management section has been expanded to include more detailed information regarding strategic surveys. Costs have been estimated for both the short term (1-5 years) and long term (6-10 years).
- A section has been added to describe anticipated effects associated with the use of prescribed fire.
- Assumptions have been added near the front of this chapter to explain the implications of reduced funding for implementation of the alternatives.
- The Conflicts with Other Plans section has been expanded to recognize that 5,400 acres managed by the Coquille Indian Tribe must be managed consistent with the Northwest Forest Plan.
- The effects analysis for the northern spotted owl added new information from a recent demographic analysis on this species and clarifies the role of Survey and Manage species' known sites in response to requests in public comments.
- The Forest Ecosystem section now includes an analysis of estimated ingrowth of forests into late-successional condition for the first decade (1994-2004) of Northwest Forest Plan implementation.
- The effects analysis for the Canada lynx has been moved from the Late-Successional Mammals section to Threatened and Endangered Species section and includes an analysis of its status under the Endangered Species Act.
- The 25-year projection of known sites and, thus, timber harvest levels, has changed based on an additional year of species survey records, removal from Survey and Manage of some of the most common species, and revisions to species capping assumptions to simulate future adaptive management changes.
- The Fungi section has been expanded to clarify and better document anticipated effects on all fungi species. In the Draft SEIS, anticipated effects for all fungi species were not explicitly stated. In addition, the Summary of Effects for Fungi section in the Draft SEIS contains an erroneous statement (not included in the Chapter 3&4 Fungi effects section) that asserted "the alternatives provide for stable well-distributed populations of these fungi species." This statement has been omitted from the Final SEIS.

# **Chapter 3&4 - Affected Environment and Environmental Consequences**

## **Introduction**

Chapter 3 (Affected Environment) and Chapter 4 (Environmental Consequences) are combined in this document, as was done in the Northwest Forest Plan Final SEIS (USDA, USDI 1994a) to more clearly present information to the readers. The text is ordered by first describing a resource or environmental component, then describing the environmental consequences to that resource or component.

This chapter describes aspects of the environment likely to be most directly affected by the proposed management. Also described are the direct and indirect effects (or impacts) of management under the alternatives, which constitutes presentation of cumulative impacts. Together, these form the scientific and analytic basis for the Comparison of Effects of the Alternatives section in Chapter 2. The regional scope of this analysis renders impractical site-specific detail in this SEIS. The Agencies will complete environmental analysis, as appropriate, for proposed site-specific activities.

This document is a programmatic SEIS, and while many of the effects are most appropriately considered at this scale and all effects are described in sufficient detail to facilitate a reasoned choice from among the alternatives, the ability to provide specific detail about some effects is necessarily limited. However, the alternatives in this SEIS do not authorize any habitat-disturbing activities. The conduct of habitat-disturbing activities must still comply with applicable environmental laws at the site-specific level, which include provisions for public notice, comments, appeals, and consideration of site-specific resources of all kinds at that scale.

## **Relationship of this Supplemental Environmental Impact Statement to the Northwest Forest Plan FSEIS**

To eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision, this SEIS is tiered to the Northwest Forest Plan Final SEIS. Whenever a broad environmental impact statement has been prepared (such as the Northwest Forest Plan FSEIS) and a subsequent environmental impact statement is then prepared on an action within the entire program (such as the Survey and Manage Standards and Guidelines), the subsequent environmental impact statement need only summarize the issues discussed in the broader environmental impact statement and incorporate by reference the discussions from the broader statement (40 CFR 1502.20).

This SEIS incorporates by reference the discussions in Chapter 3&4 of the Northwest Forest Plan Final SEIS that concern affected environment and background information relating to ecosystems, species, communities, and the economy. This SEIS builds on those discussions and adds additional discussions that address relevant changed circumstances and new information since publication of the Northwest Forest Plan Final SEIS in February 1994. The analysis of environmental consequences in this SEIS is limited to those that would possibly result from the actions described in the alternatives. Because the issues and alternatives analyzed in this SEIS are relatively narrow, the resultant effects analyses are also narrow. The environmental consequences described in the Northwest Forest Plan Final SEIS relating to other aspects and elements of the Northwest Forest Plan, that are unchanged by the alternatives in this SEIS, are assumed to remain valid.

## **Incomplete or Unavailable Information**

One step in preparing an environmental impact statement is to evaluate whether information about effects of a proposed action is incomplete or unavailable and, if so, to disclose that fact and make certain findings about the relevance, importance, and/or costs of acquiring data that could help fill any such gaps. Much of the discussion concerning these issues in the 1994 Final SEIS (pp. 3&4-3 and 3&4-4) remains relevant for purposes of the analysis in this SEIS and is specifically tiered to and incorporated by reference. Further discussion, specifically tailored to the issues addressed in this SEIS, is set forth below. This discussion is framed by a series of questions derived from the CEQ regulations (40 CFR 1502.22).

### **Is there incomplete or unavailable information about effects of the proposed action?**

As noted throughout the species effects analyses in this Final SEIS, there is much that remains unknown about many of the species subject to analysis. A principle reason many species have been identified to receive Survey and Manage mitigation measures is because relatively little is known about them. Designation of a species for additional mitigation under Survey and Manage not only provides supplemental protection as a precautionary device in the face of uncertainty, but it also provides a method to acquire additional information and begin to overcome this uncertainty.

Another source of uncertainty relevant to effects on human communities and species arises from the programmatic scale of this Final SEIS and the fact that the proposed action does not authorize any particular management actions. The effects of management can only be known, with any degree of specificity, at subsequent, site-specific levels of analysis and planning. Effects are projected in broad terms for purposes of the analysis in this Final SEIS.

### **Is the incomplete or unavailable information relevant to reasonably foreseeable significant adverse effects?**

There likely are no reasonably foreseeable significant adverse effects arising directly from the proposed action, largely because the amendments under consideration in this Final SEIS are relatively modest changes to the Survey and Manage and related standards and guidelines, all of which are mitigation measures. The proposed action does not entail any revisions to the core components of the Northwest Forest Plan. Nevertheless, some incomplete or unavailable information might be relevant to potentially significant adverse effects on individual Survey and Manage species or resource-dependent communities within the Northwest Forest Plan area arising from future projected land management activities because reasonably foreseeable significant adverse effects are defined as including “impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.”

Projected effects from future management activities are necessarily based, to a large extent, on assumptions and incomplete information because they will be the result of other decisions made at a site-specific level. For very rare species or those with extremely localized distributions, the level of such effects could be substantial and in a worst case extirpate an entire population if it were not detected and avoided through applicable Survey and Manage mitigation measures. This risk should be minimal (although varying in degree depending on the alternative). Survey and Manage is specifically designed to help conserve species and avoid such dramatic kinds of adverse effects, in particular, by requiring pre-disturbance surveys when practical. Also, the likelihood that an activity modifying late-successional forest will occur within the range of a truly rare or localized species population must be viewed in light of the relatively conservative degree of modification of late-successional forest projected to occur within the Northwest Forest Plan area. For example, management activities (timber harvest and prescribed fire) are projected to modify approximately 3 percent of the late-successional forest within the area over the next decade. Finally, any discussion of risk based on rarity and likelihood of disturbance must recognize that, for most

species, only a small percentage of potential habitat has been surveyed. With respect to the potential for significant adverse socioeconomic effects, it is not possible to pinpoint which communities may be relatively more susceptible as a result of the proposed action to incur such effects in the absence of site-specific data arising from surveys and subsequent management decisions. It should be noted that two alternatives (including the preferred alternative) generally lessen adverse socioeconomic effects compared to the no-action alternative.

The incomplete or unavailable information relevant to these potentially significant adverse effects generally can be described as additional information relating either to site-specific actions not authorized by the proposed action in this Final SEIS or to individual species such as more specific definition of range, complete set of locations, habitat associations, actual degree of rarity, and like data. A hundred species are known from 5 or fewer sites, and another hundred are known from 10 or fewer sites. Some of the species have not been seen for 30 or more years. Although a close association with late-successional forests is believed to exist, connectivity and habitat needs, range, and other specific information for many species is unknown or uncertain.

The existing credible scientific information that serves as the basis for the effects discussions in this SEIS is described in the background sections for each species or species group and is included in the administrative record, particularly in the documentation of the Species Review Process (see Appendix F) and in the ISMS database (see Appendix D). The effects writers for this SEIS built upon the information, analysis, and assessment processes described in the FEMAT report and in the Northwest Forest Plan Final SEIS. Much of the new information available about Survey and Manage species comes from the \$22 million spent by the Agencies since 1994 collecting existing information from private, agency, and other public data sources, and conducting pre-disturbance, extensive, and general regional surveys (see Appendix C). All of the effects writers are highly knowledgeable and respected experts who are aware of the available literature and other science, communicate regularly with peers in their respective fields, and were supplied species-specific information received through public comments on the Draft SEIS. The methods used by the effects writers to evaluate effects are summarized in Appendix J.

### **Is there incomplete or unavailable information relevant to reasonably foreseeable significant adverse effects that is essential to a reasoned choice among alternatives?**

No. The discussion in the 1994 Northwest Forest Plan Final SEIS (pp. 3&4-3 and 3&4-4) concerning this issue remains relevant and excerpts are worth restating here.

*The ecology, inventory, and management of large forests is a complex and developing discipline. The biology of the specific species prompts questions about population dynamics and habitat relationships. The interaction among resource supply, the economy, and rural communities is also the subject of an inexact science.*

*There is a substantial amount of credible information about the topics of this environmental impact statement; the central relationships and basic data are well established. The best available information was used to evaluate the options and alternatives... While additional information would often add precision to estimates or better specify a relationship, the basic data and central relationships are sufficiently well established that any new information would be unlikely to reverse or nullify understood relationships. Though new information would be welcome, no missing information was evaluated to be essential to a reasoned choice among the alternatives as they are constituted.*

*All other things being equal, the lesser the information, the greater the risk attributable to incomplete knowledge.*

There are differences in the level and methods of protection the action alternatives would provide for Survey and Manage species. The effects writers were aware of these differences and sought to assess the degree of protection afforded under each alternative. To the extent data exist on known

or historical sites, it was obtained and relied upon in making species effects assessments. Lack of information was also factored into the projections by assigning a relative measure of certainty for each. Thus, to the extent possible, effects writers attempted to quantify or qualitatively describe relative risks and impacts as they vary among alternatives on the basis of existing credible scientific evidence.

Moreover, the Northwest Forest Plan authorizes adaptive management and all of the action alternatives are designed to acquire and utilize additional information over time to improve management direction for species. Each of the action alternatives prescribe strategic surveys for all 346 species remaining in Survey and Manage. Alternatives 1 and 2 place a deadline of 5 years (10 years for fungi) for completing such surveys for the 222 Category B species or management activities in old-growth forests will be deferred or subject to site-specific surveys. The information from strategic surveys will be compiled at least annually and considered, along with information obtained through annual data calls and other sources, as part of the Species Review Process. Thus, there is a prescribed process for obtaining and utilizing what is now incomplete and unavailable information about species. Further, the standards and guidelines call for more conservative category assignment where information is divided or uncertain.

Obtaining sufficient information about these species to add substantial confidence to the comparative analysis in this Final SEIS by means other than those provided in the alternatives would require exorbitant costs and/or many years of data gathering. An example of how such additional information might be collected would be for the Agencies to conduct “census” surveys for all Survey and Manage species on the more than 20 million acres of lands administered by the Forest Service and BLM within the Northwest Forest Plan area.

## **Cumulative Impacts**

Cumulative impacts to the environment are defined in the CEQ regulations as those that result from the incremental effects of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes them (40 CFR 1508.7). Given the programmatic nature and scale of this SEIS, most of the environmental consequences discussed represent a general projection of the accumulated effects of management actions that are reasonably assumed to occur given the current status of federally managed lands and the full complement of standards and guidelines in the Northwest Forest Plan.

This is similar to the analytical approach taken in the 1994 Final SEIS (USDA, USDI 1994a, Appendix J3), which this SEIS supplements, where it was noted that the assessment of species effects focused on the likelihood that alternatives would provide species’ habitat in varying amounts and distributions on federally managed lands. The intent of this focus, then as now, “was not to ignore possible problems resulting from cumulative effects, or to make the assumption that viable populations of species could be supported by non-federal lands alone.” (USDA, USDI 1994a, Appendix J3). Rather, the intent was and continues to be to make explicit the “benefit expected to accrue to...species...from habitat provided on federally managed lands under each of the alternatives” (USDA, USDI 1994a, Appendix J3).

The primary focus of the analysis in this SEIS is on federally managed lands, for reasons similar to those that applied to the 1994 Final SEIS. For some of the species addressed here, the interactions between effects on federally managed lands and nonfederal lands are expected to be somewhat limited largely because of the sedentary natural history of these species and their apparently limited dispersal capabilities. Therefore, while species sites on nonfederal lands may be important to maintaining the overall distribution of the species, interactions among sites on federally managed lands and sites on nonfederal lands are expected to be limited for most Survey and Manage species. For species with some dispersal ability, the potential exists for interactions between federal and nonfederal sites; in general, any such interactions are more important for species in areas of highly fragmented habitat.

Although most of the effects described in the 1994 Final SEIS related to actions on federally managed lands, it also discussed projected effects resulting from anticipated nonfederal actions, including the management of nonfederal forests in the Northwest Forest Plan area. The majority of that discussion is applicable to the alternatives discussed in this SEIS, especially in light of the fact that the proposed action for this SEIS addresses only one component, Survey and Manage and related mitigation measures, of the larger conservation strategy comprising the Northwest Forest Plan. In addition, a portion of the cumulative effects analysis in the 1994 Final SEIS, Appendix J2, addressed in varying detail, the cumulative effects relating to species that are the subject of the analysis in this SEIS. General categories of effects other than federal forest management discussed in the 1994 Final SEIS included: (1) potential disturbance of species sites on nonfederal lands; (2) potential disruption of connectivity across the landscape; (3) chemical spraying; (4) overharvest of the species as a special forest product; (5) impacts on water quality from a variety of nonfederal activities; (6) disruption of hydrological patterns by hydropower development and irrigation diversions; (7) riparian area management; (8) impacts of air pollution; and, (9) global climate change.

Given this analytical framework and the rather extensive cumulative effects analysis in the 1994 Final SEIS, the cumulative effects analysis in this SEIS is focused primarily on actions that have taken place since completion of the earlier analysis or that are now reasonably foreseeable within the meaning of the relevant CEQ regulations.

A number of recent federal actions, not directly related to implementation of the Northwest Forest Plan, are relevant to assessing cumulative effects on Survey and Manage species.

First, there have been a series of changes to federal land allocations within the Northwest Forest Plan area since 1994. A notable example is the creation of the Cascade-Siskiyou National Monument in June 2000 by presidential proclamation. The national monument is located entirely within the Northwest Forest Plan area in southern Oregon and includes approximately 52,000 acres of lands administered by the BLM. Land allocations under the Northwest Forest Plan prior to the national monument designation included Late Successional Reserves, a Wilderness Study Area, Matrix, Riparian Reserves, several Areas of Critical Environmental Concern, Research Natural Areas, and the Pacific Crest Trail. In making this designation, the President noted, among other things, the area's old-growth habitat and spectacular biological diversity. The proclamation designating the national monument states that commercial timber harvest is no longer permitted within the national monument and motorized and mechanized vehicle use is prohibited off roads. It also withdraws these lands from entry under the public lands and mining laws. Thus, incidental benefits may accrue to Survey and Manage species that are local endemics within the Cascade-Siskiyou National Monument.

Second, there have been a few relatively large land exchanges or federal land acquisitions within the Northwest Forest Plan area that could have effects on Survey and Manage species. These effects would accrue to the extent that old-growth or late-successional forest habitats were acquired through exchanges (and similar habitat retained) and provide habitat for Survey and Manage species. It should be noted, however, that all of these exchanges or acquisitions were for a variety of purposes; none were purposefully related to acquisition of habitat for Survey and Manage species. In some cases, locations of species may be involved in the land exchanges. Some examples of land exchanges include the I-90 land exchange in the central Cascades of Washington and the Mount Hood Corridor exchange in northern Oregon. Specific effects of these exchanges on Survey and Manage species are not known. Since 1994 the Forest Service also has acquired, through purchase, approximately 37,000 acres. The BLM also acquired the Headwaters Forest in northern California. As with land exchanges, these purchases have not been targeted for Survey and Manage species. However, incidental benefits may accrue to some species, particularly those that are rare and endemic. For example, acquisitions in the Columbia River Gorge National Scenic Area could be beneficial to some rare mollusk species as well as to the Larch Mountain salamander.

Third, a number of species found within the Northwest Forest Plan area have been listed as endangered or threatened pursuant to the Endangered Species Act, including numerous fish stocks (see Appendix G). Listing under the Endangered Species Act triggers various protective measures that are expected to provide some unquantifiable degree of incidental benefits for Survey and Manage species associated with aquatic or riparian habitats, especially on nonfederal lands. Under Section 7 of the Endangered Species Act any federal actions that may affect a listed species must undergo consultation with the National Marine Fisheries Service or U.S. Fish and Wildlife Service. Section 9 of the Endangered Species Act further prohibits actions that “take” endangered species unless prior specific authorization is obtained. One method that nonfederal landowners may use to obtain authorizations to incidentally take a species is through completion of a Habitat Conservation Plan for the species in accordance with Section 10; specific examples are discussed in more detail below. The National Marine Fisheries Service also has issued special 4(d) rules for threatened salmonid stocks that have been listed since 1994. These rules provide guidelines for conservation objectives that must be attained in order for an action to avoid a prohibited take under the Endangered Species Act. Therefore, to the extent Survey and Manage species rely on or exist within the same kinds of habitat as do the newly listed species, they can be expected to receive incidental benefits as a result of the listings.

The U.S. Fish and Wildlife Service has approved a number of Habitat Conservation Plans for threatened and endangered species in connection with issuance of incidental take permits for actions on nonfederal lands within the range of the northern spotted owl. Habitat Conservation Plans are entered into between the U.S. Fish and Wildlife Service (and the National Marine Fisheries Service, if species under the regulatory authority of that agency are included) and nonfederal landowners under authority of Section 10 of the Endangered Species Act to provide for habitat conservation and management of a variety of listed (and some non-listed) species, most notably in this area for the northern spotted owl and marbled murrelet. These Habitat Conservation Plans, with the number of approximate acres covered by each, include: (1) in Oregon, Elliott State Forest in Coos County (93,000 acres), Grover Tree Farm near Brookings (86 acres), City of The Dalles Municipal Watershed (1200 acres), and Weyerhaeuser’s Millicoma Tree Farm in Coos County (209,000); (2) in Washington, Washington Department of Natural Resources Lands in western Washington (1.6 million acres), Cedar River Watershed in King County (90,000 acres), Murray Pacific Corporation in Morton (55,000 acres), Plum Creek Timber near Cle Elum (170,000 acres), Port Blakely RB Tree Farm near Raymond (8000 acres), Crown Pacific-Hamilton Tree Farm in Whatcom and Skagit Counties (85,000 acres), and Simpson Timber NW Operations in western Washington (214,000 acres); and, (3) in California, Pacific Lumber in Scotia (211,000 acres) and Simpson Timber Company in northern California (380,000 acres).

These Habitat Conservation Plans are distributed across the Northwest Forest Plan area. In general, where the plans call for conservation of older forest, specific habitat structure, or longer rotations, they may incidentally provide for habitat and sites of Survey and Manage species on nonfederal lands. In addition, some of these Habitat Conservation Plans were expressly designed to build upon and complement the conservation benefits for their covered species arising from the Northwest Forest Plan. Conversely, to the extent they allow for harvest of late-successional and old-growth forest habitat, they may incidentally result in loss of sites or habitat of such species. Because these Habitat Conservation Plans generally were not designed to address Survey and Manage species, the relative conservation benefits or detriments accruing to each such species can only be addressed in a general sense.

Several Survey and Manage species are specifically mentioned within one or more of these Habitat Conservation Plans. The species for which conservation benefits or adverse impacts are described are limited primarily to vertebrates and vascular plants, although some discussion and effects analysis is provided for some mollusks and invertebrates. Rarely are fungi, lichens, or bryophytes discussed in the Habitat Conservation Plans or supporting NEPA documents. Some benefits may accrue to Survey and Manage species either directly due to provisions of the Habitat Conservation Plan or incidentally as a result of implementing habitat management measures targeted for other species. Examples of habitat conservation measures incorporated into Habitat



Conservation Plans that may provide some benefits to Survey and Manage species include: (1) buffers around caves and talus slopes; (2) limited entry or no-entry zones along riparian areas; (3) surveys to inventory and monitor populations or habitats of riparian-associated species; (4) deferral of harvest of some stands to provide late-successional forest conditions; (5) retention of down wood and leave trees in and near harvest units; (6) requirements to maintain or restore roads and landings; and, (7) conducting watershed analysis and landscape planning.

Because the majority of these Habitat Conservation Plans do not specifically address most Survey and Manage species, few benefits to the species are assumed to accrue from actions taken under these Habitat Conservation Plans. For other Habitat Conservation Plans, benefits may incidentally accrue to Survey and Manage species from implementation of habitat conservation measures designed and intended to benefit species covered by the Habitat Conservation Plan. Only in rare cases are Survey and Manage species directly benefitted by measures implemented under terms of a Habitat Conservation Plan. Due to these circumstances, the net effect from Habitat Conservation Plans on Survey and Manage species is not possible to assess with any specificity. In addition, each Habitat Conservation Plan supports the issuance of an incidental take permit that authorizes modification of habitat of listed species. To the extent authorized habitat modification coincides with the presence of Survey and Manage species, such species likely will suffer adverse effects. In summary, there is too little information and too much uncertainty of actual benefit or adverse impact to support any definite conclusions regarding the overall effects of Habitat Conservation Plans on Survey and Manage species.

Fourth, the U.S. Environmental Protection Agency recently published a final regulation for the Total Maximum Daily Load program under Section 303(d) of the Clean Water Act. Under this program, the Environmental Protection Agency is committed to work in partnership with state and local governments to develop common-sense, flexible solutions for specific waterways that have been identified by Environmental Protection Agency and states as not meeting applicable water quality standards. There are water bodies within the Northwest Forest Plan area that have been identified as not meeting applicable water quality standards. The Environmental Protection Agency and the land managing agencies have developed a protocol to address these water bodies and are currently working together with the states to verify their listing and develop schedules to bring the water bodies into compliance with applicable standards. To the extent these compliance plans improve protection of aquatic and riparian habitat, those Survey and Manage species that exist in such habitat can be expected to receive some incidental benefit.

Finally, in 1995 Congress enacted the Rescission Act (Public Law 104-19) which authorized a number of timber sales. The Regional Ecosystem Office (REO) conducted an analysis of the effects of these sales within the Northwest Forest Plan area. The REO has concluded that, at the ecosystem-wide scale, overall habitat conditions on federally managed lands within the range of the northern spotted owl have not been changed to an extent that would diminish the ability of conservation strategies adopted by the ROD to achieve their intended objectives. The REO determined there is no need to develop ecosystem-wide amendments to the Northwest Forest Plan Standards and Guidelines to accommodate the harvest effects of Rescission Act sales. The REO also concluded that the underlying assumptions used for the broad-scale analysis of habitats, species ranges, existing and future conditions, and conservation strategies in the 1994 Northwest Forest Plan Final SEIS would not be affected by the release or harvest of any or all of the 48 Rescission Act sales.

In addition to recent federal actions, there are also several reasonably foreseeable actions that would be relevant to cumulative effects on Survey and Manage species. For example, the Forest Service has published a Draft EIS and proposed regulations regarding management of inventoried roadless areas (65 FR 30276 (May 10, 2000)). In the Northwest Forest Plan area, there are less than 1 million acres covered by the proposed regulations. If implemented as described in the preferred alternative, the proposed regulations would prohibit road construction or re-construction, but not necessarily timber harvest, within these areas. More than 50 percent of these areas are designated Key Watersheds under the Northwest Forest Plan and new road construction already is prohibited. It is likely that these areas contain habitat and sites for some Survey and Manage

species. Implementation of the preferred alternative of the proposed roadless area rules would likely reduce threats to these species.

The Forest Service also has issued a proposed set of revised National Forest Management Act planning regulations that are expected to be promulgated in final form in the near future (64 FR 54095 (Oct. 5, 1999)). The proposed regulations allow for a transition period before they apply, which generally would occur during the next land and resource management plan revision. All site-specific decisions made after 3 years of the revised regulations' effective date would have to be in conformance with such regulations. As a result, if the transition section of the proposed regulations is adopted as part of any final rule, the latest the revised planning regulations would apply to site-specific management actions projected to occur under the alternatives analyzed in this SEIS is 3 years. The most relevant provisions of the proposed regulations to this SEIS are those that address ecological sustainability, which, although framed somewhat differently from the present version of the National Forest Management Act viability provision, would not be expected to necessitate any fundamental or significant change to the preferred alternative in this SEIS to bring it into alignment with the new rules. Many of the concepts the proposed regulations rely on are consistent with the persistence objectives that are an integral part of the proposed action for this SEIS. It is premature and beyond the purview of this SEIS to attempt to offer any final judgment about whether the alternatives analyzed in detail would comply with the final regulations, when promulgated. Instead, this discussion is simply an attempt to address the potential cumulative effects of a reasonably foreseeable action.

There also has been some nonfederal actions addressing nonfederal forest management that may have effects on Survey and Manage species. Since adoption of the Northwest Forest Plan, the States of Oregon and Washington have modified their forest practices rules to provide for greater environmental protection. These modified rules could have additional benefits to Survey and Manage species if species are located on lands covered by those changes. Benefits could also accrue from the State of Oregon's "Salmon Plan." Those benefits would apply to nonfederal lands within the Oregon portion of the Northwest Forest Plan area.

The individual species effects analyses for amphibians, fungi, lichens, and red tree vole also recognize potential adverse impacts associated with nonfederal lands. For the red tree vole, in particular, nonfederal actions have greater importance and are discussed more specifically in the species effects analyses of this SEIS. Cumulative effects to red tree voles were assessed in detail because connectivity of populations is a particularly important issue for the species given its limited dispersal capabilities and the distribution of federal and nonfederal lands within its range. As a result, in areas where the land ownership pattern consists of alternating sections of federal and nonfederal lands, connectivity of populations becomes more dependent on the combination of federal and nonfederal management actions. To more clearly identify and allow for a relative comparison of the effects on red tree vole habitat on both federally managed land and on all lands, separate assessments were conducted. The first assessment addressed the amount and distribution of habitat that would be provided on federally managed land. The second assessment addressed the overall effect expected due to both federal and nonfederal management. For the details of these assessments, refer to the specific species effects analysis sections later in this chapter.

With respect to salamanders, the Background and Affected Environment discussions in this SEIS address newly discovered sites and range extensions. Concerns for habitat on nonfederal lands is expressed for the Shasta and Van Dyke's salamanders. These concerns were noted in Appendix J2, which also identified possible cumulative effects from nonfederal lands on the Siskiyou Mountains salamander. Although sites on federally managed lands now account for over 90 percent of known sites and the range of the Siskiyou Mountain salamander has been expanded, cumulative effects for this species are of concern in the southeastern extent of its range, where federally managed land is limited and genetic diversity indicates there is the potential for a new species of salamander (Mead, et al. 2000). Likewise, cumulative effects are of concern over parts of the species' ranges where federally managed land is limited for Larch Mountain and Del Norte salamanders.

Appendix J2 addresses cumulative effects to many Survey and Manage species. Additional new information has been collected for many species on federally managed lands as discussed in the following effects sections. However, except as noted below, very little new information has been collected for Survey and Manage species on nonfederal lands within the Northwest Forest Plan area. The cumulative effects discussions in Appendix J2 generally remain valid. Some of the more prevalent concerns centered around land ownership patterns, air pollution, global climatic change, connectivity, riparian area management, recreation use, and harvest of special forest products. Impacts similar to or worse than those described in this SEIS could be anticipated for any rare endemic species located on nonfederal lands. However, as assumed in the Northwest Forest Plan Final SEIS, nonfederal lands may not provide much habitat for these late-successional or old-growth forest associated species.

Finally, relatively greater effects arising from timber harvest may occur on nonfederal lands both within and outside the Northwest Forest Plan area to the extent that harvest levels are reduced on federally managed lands due to management for Survey and Manage species and demand for wood products remains relatively constant. Such effects could occur on lands managed under more intense silvicultural practices and with fewer environmental constraints than those which apply under the Northwest Forest Plan, including in some foreign countries with very limited environmental controls (some Survey and Manage species are known to occur in foreign countries). In very general terms, the lesser the harvest on federally managed lands within the Northwest Forest Plan area as a result of the Survey and Manage measures, the greater potential effects can be expected on other forested lands. This analysis is consistent with a recent speech by the Chief of the Forest Service to the American Forest and Paper Association, in which he said: “For one thing, cutting off the timber supply from our national forests would do nothing to curtail our Nation’s growing appetite for wood products. It would only shift environmental problems to other lands where environmental protections are fewer. In the absence of a national consumption ethic, we must continue to meet at least part of the Nation’s demand for timber. Although the mix of uses continues to shift, multiple use remains alive and well. And timber harvest will remain a part of it.”

## **Background**

### **Relationship of Survey and Manage to the Northwest Forest Plan**

#### **Effects Assumptions Relating to Survey and Manage Standards and Guidelines**

The Survey and Manage Standards and Guidelines were a mitigation measure added to the preferred alternative in the Northwest Forest Plan Final SEIS and adopted in its Record of Decision. This mitigation measure was included to help maintain or improve the distribution and stability of certain species across federally managed lands and/or to decrease the likelihood of extirpation of these species from federally managed lands in the Northwest Forest Plan area. The analysis of environmental consequences of the alternatives in this SEIS must be understood in the context of the overall Northwest Forest Plan. Species persistence measures (see Chapter 2 and glossary) in the Northwest Forest Plan generally comprise a combination of seven different land allocations (or designated areas) and many different standards and guidelines. The Survey and Manage Standards and Guidelines, similar to the other standards and guidelines in the Northwest Forest Plan, do not work independently, but rather work collectively and synergistically to support species persistence. Thus, an evaluation of species persistence cannot be limited to consideration of any single standard or guideline. A comparison of the relationship and relative acres projected to be managed as known sites for Survey and Manage species in Matrix and Adaptive Management Areas, with acres managed in the reserves system of the Northwest Forest Plan, is shown in Figure 3&4-1.

Although overall effects on species cannot be attributed to a single standard and guideline, the benefits to species of a given land allocation or a given standard or guideline can be distinctly

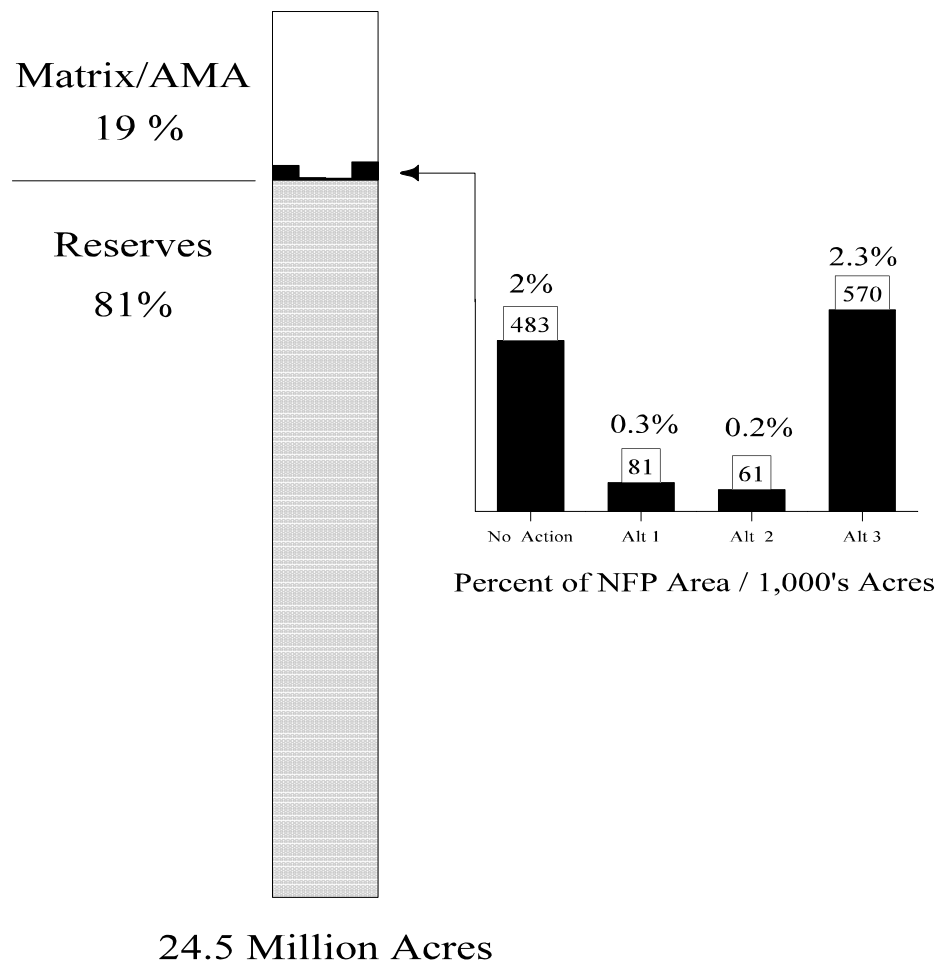
projected. The proposed action subject to analysis in this SEIS would refine only the Survey and Manage Standards and Guidelines of the Northwest Forest Plan. It is important to understand in the effects analysis that the Survey and Manage Standards and Guidelines were a mitigation measure added to the Northwest Forest Plan that increased the confidence of providing for species persistence, but were not and are not, by any means, the sole factor contributing to persistence in the plan. The Northwest Forest Plan Final SEIS (USDA, USDI 1994a, p. 3&4-122) acknowledged this difficulty:

*“The assessment was meant to help determine when the cumulative effects of such incremental losses of habitat might result in risk to the species’ survival. As discussed above, this determination is problematic. Background information about exact habitat requirements of many organisms does not exist, nor is it possible to accurately predict the exact consequences of each potential land management activity for all species.”*

## Species Persistence Objectives

The projected success of the Northwest Forest Plan in providing for late-successional and old-growth forest associated species varied depending upon: (1) whether the species was a native or desirable non-native vertebrate; (2) the species relative distribution, natural rarity, and inherent

**Figure 3&4-1.** Relative effects of different Survey and Manage alternatives upon acreage covered by the Northwest Forest Plan. Reserves portion includes all federal acres regardless of vegetation condition, about one-third of which is late-successional forest. Additional bars extending into the Matrix and Adaptive Management Area (AMA) represent the acres projected to be managed as known sites for Survey and Manage species under each of the four alternatives, most of which are expected to be late-successional forest.



risk (see below); and, (3) whether (and to what degree) reducing risk was practicable. The persistence objectives for vertebrates and non-vertebrates are described in more detail under the Species Persistence Objectives section in Chapter 2.

Some species are naturally so rare that they are inherently at risk from some large-scale disturbance or other factor. Many of these species are known from 5 or fewer sites and others are known from 6 to 10 sites. Reductions in the harvest of late-successional and old-growth forests would provide some reductions in concerns to these species, but the actual change is unknown due to incomplete understanding of species abundance and distribution. Uncertainty based on species rarity simply prevents the development of any additional practicable mitigation measures within the scope of this SEIS that could reasonably be expected to provide for a greater assurance of persistence with any meaningful degree of certainty. Where very rare species are late-successional forest associated and Survey and Manage Standards and Guidelines can reasonably be expected to contribute to their persistence, they are proposed to remain in Survey and Manage, and they receive roughly equal protection under the action alternatives as they do under the No-Action Alternative. Under the action alternatives (1) known sites are managed for these species; (2) strategic surveys will be conducted for these species; and, (3) if pre-disturbance surveys are practical, they will be conducted prior to habitat-disturbing activities.

Final determinations of whether the selected alternative will provide a reasonable assurance that the species persistence objectives defined as part of the Purpose and Need of this proposed action will be met and whether the selected alternative meets all applicable regulations will be made in the Record of Decision after considering the information about species and other impacts presented in this SEIS and related references and records.

### **Patterns of Biological Distribution and Their Relationship to Effects Analysis**

An overall goal of this mitigation measure is to provide for stable populations of these species, well-distributed across federally managed lands in the planning area, to roughly the same degree as that achieved by the 1994 Northwest Forest Plan ROD. The effects analyses consider and seek to project the influence of the alternatives on the distribution and population stability of these species. The effects analysis process is summarized below. The full set of directions provided to writers of the effects analysis is provided in Appendix J.

For purposes of the analysis concerning Survey and Manage species in this Final SEIS, well-distributed means “distributed sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitat for which it is specifically adapted.” The natural history of the species considered in this SEIS resulted in historic distributions that followed many different patterns. In order to analyze distribution, writers of the effects analyses first attempted to estimate the reference state of each species’ distribution. Writers were asked to base reference distribution on the known historic, or inferred, biological distribution pattern. For purposes of the analysis in this Final SEIS, historic refers to the time period before European settlement, but must be estimated over a long enough period of time to encompass the range of variability resulting from all known forms of pre-settlement disturbance and ecological processes. Where reference distribution was inferred, it was based on available information about habitat associations, occupancy of suitable habitat, historic habitat distribution, potential past disturbance, and other ecological evidence in the planning area. The reference distribution was considered “well distributed” and served as a baseline tool to facilitate comparison of historic, current, and future conditions in this Final SEIS (but should not be interpreted as a management goal or normative legal standard). Thus, a species with a very restricted range would normally be considered to be “well distributed” for purposes of the analysis in this Final SEIS if its current distribution approximates its known or inferred historic distribution.

To assess distribution patterns across taxa and to make determinations of whether species are well distributed, basic knowledge is needed of species rarity patterns (Rabinowitz 1981), population structure and dynamics, connectivity, and fragmentation (e.g., Hanski and Gilpin 1997; Harrison 1994; Meffe and Carroll 1997).

Across the broad diversity of taxa being considered in this Final SEIS, reference distributions may range from isolated sites to relatively widespread or continuous patterns across the planning area, with a continuum of possible intermediate patterns having varying degrees of connection. As a framework for the effects analysis in this Final SEIS, four distinct patterns of species distribution are described, as follows:

1. **Isolated sites** – Relatively few, highly isolated sites or populations, with little to no potential for gene flow between them; may be known from a single site.
2. **Isolated site clusters** – Distributed as groups or clusters of occurrences or subpopulations, with some potential for dispersal and/or gene flow within the groups but little potential for dispersal or gene flow between the isolated clusters.
3. **Limited connectivity among multiple sites and/or clusters** – Groups or clusters of occurrences or subpopulations (some as strings of sites) with intra-cluster connectivity and some potential (based on species-specific spatial scale or configuration, over appropriate time periods) for connectivity among isolated sites or isolated site clusters. Connectivity may occur through intervening suitable habitat, refugia, or secondary dispersal habitats.
4. **Multiple avenues of connectivity among sites and clusters** – Multiple sites and/or clusters of sites within a web of potential inter-connections; includes multiple potential connectivity pathways occurring in diverse landscape and habitat conditions that may include natural gaps in distribution of suitable habitats.

As indicated above, species distributed in a pattern similar to the reference distribution would be considered well distributed for purposes of the analysis in this Final SEIS. Conversely, species whose distribution has been substantially altered via human-caused disturbance from the reference distribution, or would be altered from the current state under one or more of the SEIS alternatives, would be considered as not well distributed under that same analysis. To become *not well distributed* is a taxon-specific determination; a taxon may undergo an alteration of distribution pattern or may have a substantially altered distribution within a particular pattern. Substantial alteration might be indicated through overall changes to distribution or if interactions among individuals are limited in some portions of their range.

For the four distribution patterns discussed above, substantial alteration may be indicated, in general, by the following:

1. For a species distributed in isolated sites, loss of any sites might be considered a dire condition and assessed as becoming not well distributed.
2. Loss of single sites, multiple sites, or clusters that serve a significant role for population persistence or in the species' biological diversity might result in a determination of not well distributed, depending on total number and distribution of sites and clusters across the species range.
3. A result of not well distributed normally results only from loss of sites or clusters that affect overall population persistence, such as source subpopulations, those within connectivity areas, or loss of genetic and biological diversity of the population. Loss of a cluster for species with few clusters, relative to species range, distribution, and effective population size, could result in a species becoming not well distributed.
4. It might be possible for species in this pattern to remain well distributed with numerous losses of non-significant sites and connections among sites and some gaps in distribution. However, fragmentation could be a serious risk to population stability and the projected distribution pattern need not completely change to the limited connectivity category for it to become not well distributed.

Species having a mix of distribution patterns should be assessed under the different management alternatives and compared to their reference distribution. To become not well distributed, the change within and among patterns are described using concepts as previously discussed, for individual component patterns of the mix.

## **Population Stability**

In evaluating population stability of the species addressed in this Final SEIS, a 100-year timeframe was established to provide a baseline against which comparative judgments could be made. A part of the persistence objectives for these species is population stability. For the purposes of this Final SEIS, a stable taxon is defined as one that “over time, maintains population numbers, given inherent levels of population fluctuation and variability of habitats to which they are adapted. The species may become stable at a different population level than the current or (inferred) historical level.” Thus, stability as used in this Final SEIS allows for the possibility that, and may well be consistent with, varying levels of reductions in actual species population or number of sites. In assessing persistence over 100 years, population stability, distribution (allowing for the species inherent population fluctuations), and genetic diversity were all considered.

## **Outcomes Determined from Species Stability and Changes of Patterns of Distribution**

For many of the species being considered in this Final SEIS, information about ecology and habitat use is scarce. In the face of such sparse data, and in an attempt to provide for a more objective comparison of the projected effects of the alternatives, a series of outcomes were described to foster translation of available knowledge about species distribution and population stability into categories that could better inform management decisions. Species effects writers considered the information available for each species or species group and estimated the changes that could occur to species distribution patterns and stability as a result of implementing each of the alternatives (see Appendix J.) As part of this process, the species reference distribution was described and compared to current conditions and to estimated conditions projected to result under each of the alternatives. By this means, the effects of the alternatives were assessed and a reasoned determination made of their relative likelihood of meeting species persistence objectives. The four potential outcomes based on population stability and distribution patterns are:

**Outcome 1:** Habitat (including known sites) is of sufficient quality, abundance, and distribution to allow species to stabilize in a pattern similar to reference distribution.

**Outcome 2:** Habitat (including known sites) is of sufficient quality, abundance, and distribution to allow species to stabilize in a pattern altered from reference distribution with some limitations on biological functions and species interactions.

**Outcome 3:** Habitat (including known sites) is insufficient to support stable populations of the species.

**Outcome 4:** Information is insufficient to determine an outcome.

## **Uncertainty in Relation to Outcomes**

As previously stated, for many of the species being considered in this Final SEIS, there is little information available, due primarily to the species' overall rarity (or rarity within the planning area), the short time during which organized surveys have been conducted, and/or the lack of knowledge about any specific habitat parameters or characteristics that tend to correlate with species occurrence. As such, it was determined that it would be useful to state the results of the above analysis with varying degrees of uncertainty. For purposes of this analysis, uncertainty is defined as “the lack of predictability due to the lack of information (basis to predict an outcome) or due to the unpredictable environmental variation and stochasticity (risk to projected outcome). Natural disturbances within the expected range of variability should not be considered uncertainty.”

Uncertainty must also be weighed in relation to projected species outcomes under each of the alternatives. Uncertainty is addressed through consideration of management priorities to obtain additional species information through strategic surveys and through a conservative approach to assigning species to categories that provide protection until additional information is acquired to ensure an acceptable assurance of persistence under a less protective category.

More detailed information regarding the process used to develop the species-specific effects analysis is presented in Appendix J.

## **Determination of Outcomes**

The effects sections for Survey and Manage species describe the effects of each alternative on each of the species or taxa groups, and disclose a projected outcome of implementing that alternative, given the analysis of available information. The analytical process was developed by the Agencies for the purposes of establishing a consistent method of analysis across these diverse taxa groups and achieving clearly stated conclusions of the projected effects to the species from implementing the various alternatives. This process included the consideration of the available data within the concepts expressed above. The determination of an outcome for each species under each alternative was based on individual assessments by taxon specialists of the alternative's ability to support stable populations of these species distributed in a pattern similar to their reference distribution. In addition, a statement of the level of uncertainty, as described above, was associated with Outcomes 1, 2, and 3.

More specifically, effects were assessed by individual agency specialists who have expert knowledge of the species being assessed or of closely related groups of species. Information used in reaching conclusions about effects on species included: (1) knowledge of species life history derived from the scientific literature and other sources; (2) species' known sites including, at a minimum, the location of the site and the date of its identification; (3) knowledge of land allocations and standards and guidelines in the Northwest Forest Plan; (4) previous assessments of species status documented in the FEMAT report and in Appendix J2 of the Northwest Forest Plan Final SEIS; and, (5) knowledge of the mitigation measures proposed under each of the alternatives in this SEIS.

With that information as a base, the projections of effects were based on the expert opinions of the individual species' specialists framed within the parameters of the process prescribed by the Agencies, with appropriate assumptions and outcome classes as described in this section. Reviews of the specialists' analyses of species effects, including follow-up questions, proposed revisions, and editing for clarity and consistency, were undertaken by members of the SEIS team. Other than this limited editing, the sections describing effects on species were not modified without the express approval of the relevant species effects writer(s). Thus, the description of effects presented in this document represent the work and substantive judgments of the individual species specialists (within the framework of the analytical process prescribed by the Agencies) and not a more broadly-framed position of the Agencies.

It should be noted that there are numerous sources of uncertainty in these expert assessments. These include uncertainty due to:

1. Limited knowledge of species life history including habitat relationships, reproductive characteristics, survival, and dispersal characteristics.
2. Limited knowledge of the historical status of species.
3. Limited knowledge of the current status or trend of species populations other than information on known sites.
4. Uncertainty concerning the effects of habitat-disturbing activities on species.
5. Uncertainty surrounding the exact type and location of activities that would be conducted on federally managed lands.
6. Uncertainty concerning activities on nonfederal lands.
7. Uncertainty about the type, location, timing, and intensity of natural disturbances.



Notwithstanding these various sources of uncertainty, the species effects assessments are based on the best available information concerning the potential future status of these species and reflect expert judgments of the qualified agency personnel who drafted the assessments. As such, they are highly instructive and useful to the present analytical effort so long as the necessary limitations and inherent uncertainties of such assessments are disclosed and kept in mind.

## **Changes in Effects Analyses**

The effects sections for Survey and Manage species describe the effects of each alternative on each of the species or taxa groups and disclose the likely outcome of implementing that alternative, given the analysis of available information. Based on both public comment and internal review, the effects analysis evolved as this SEIS was prepared. The goals were to: (1) use common definitions of terms; (2) use standard descriptions of species distribution patterns; (3) use a standard set of outcomes statements for describing effects on species; (4) provide consistency in the organization of the effects sections; and, (5) arrive at consistent conclusions regarding the effects of the alternatives.

In addition to the forms and processes described above, in Appendix J, and the species specific information the experts brought with them, information relating to implementation of the alternatives was provided to the effects writers. This provided common information and assumptions for estimating the effects of the alternatives across taxa. Numerous iterations were required to arrive at consistent language and interpretation of effects of the alternatives.

## **Effects Assumption Relating to the No-Action Alternative**

Although the current standards and guidelines provide for changing species between categories and removing species from Survey and Manage based on new information, the Need section in Chapter 1 explains that there is no specific criteria included. For these and other reasons, the Agencies have been reluctant to change the No-Action Alternative over time, as was clearly intended by the Northwest Forest Plan. In fact, the purpose of the action alternatives is to clarify and correct this omission and display the effect of moving species at this time. In order to provide a comparison between the No-Action and the action alternatives, it is necessary to depict the No-Action Alternative as fixed at its current point. For comparison purposes in the effects section of this SEIS, the standards and guidelines of the No-Action Alternative and the species to which they apply are assumed not to change over time. This assumption is necessary in order to provide a benchmark enabling the decision-makers to compare the magnitude of environmental effects of the action alternatives.

It would be more accurate to assume the No-Action Alternative would change over time as clearly intended in the Northwest Forest Plan Standards and Guidelines, with changes occurring as administrative actions or using environmental assessments. Such an assumption would create a moving target of suppositions that would become untenable when describing effects to species. The point here is that effects attributed to the No-Action Alternative may not represent actual long-term effects, if the No-Action Alternative were to be selected. Future actions, probably less than those attributed to the action alternatives, would undoubtedly be implemented in some manner.

## **Effects Assumptions Relating to the Action Alternatives**

### **Timing for Pre-disturbance Surveys**

The preparation of this SEIS was well under way prior to the August 1999 ruling by the U.S. District Court for the Western District of Washington that the Agencies' 1996 and 1998 interpretations of when "implementation" applied to activities was not consistent with the language in the Northwest Forest Plan Record of Decision (USDA, USDI 1994b). The experts writing the species effects sections of this chapter were familiar with, and continued to assume application of, the Agencies' interpretation that the requirement to conduct pre-disturbance surveys

applied to activities for which the National Environmental Policy Act (NEPA) decision or decision document had not been signed. Therefore, one of the assumptions in the effects analysis is that the timing requirements for surveys were consistent with the Agencies' direction dated September 11, 1998 (1736-PFP(BLM-OR931)P/1950(FS)) defining "implementation." They assumed the requirement for pre-disturbance surveys prior to conducting activities ended at the date that a project-level NEPA decision or decision document is signed. Using this assumption, the habitat modifications expected to occur as the result of NEPA decisions previously signed in conformance with the Agencies' 1998 interpretation were assumed, for analysis purposes, to have already taken place.

Under the Settlement Agreement and application of the court's ruling, additional surveys have been conducted for many activities, even where NEPA decisions had been signed. The effect is a slight increase in the number of managed known sites for some species over the number assumed by the experts writing the species effects sections. In the context of the entire analysis, the time period of the plan, and the percentage of the habitat that has been affected by these additional surveys, this increase is relatively insignificant and was not expected to alter any effects. In any event, it would not alter the relationship between the alternatives.

### **Contribution of Pre-disturbance Surveys and Strategic Surveys to Reducing Risk**

The relationship between pre-disturbance surveys and strategic surveys is complex. It is important to understand what the two types of surveys do and how they each contribute individually, or in combination, to reducing risks to species persistence. The following discussion summarizes some of the key benefits of each of the two different types of surveys. Chapter 2 describes the specific requirements for each of these two types of surveys and their application to the different categories in each alternative.

Pre-disturbance surveys are designed to clear projects and are conducted only where habitat-disturbing activities are planned, which may not be in the most likely habitat for the target species. For species for which such surveys are practical (e.g., Categories 1A and 1C), this element means future sites will be found and managed, and risks to species persistence should be low even if strategic surveys were not conducted. Pre-disturbance surveys are conducted only in proposed activity areas, primarily in Matrix and Adaptive Management Areas. Therefore, they provide only limited information about parameters such as population size, range, or whether a species is adequately represented in reserves.

Alternative 3 adds equivalent-effort surveys (another type of pre-disturbance surveys) for species for which pre-disturbance surveys are not practical. Although a relatively small percentage of occupied sites are expected to be found with such surveys (the actual amount depends on the characteristics of the species and other factors, such as weather conditions during the year of survey), such surveys would prevent the inadvertent loss of some sites and thereby lower risk to species persistence when compared to categories not requiring pre-disturbance surveys for these species.

Strategic surveys are the primary tool for determining the status and best management direction for most species because of their range-wide focus and systematic or scientific design. They contribute information about whether the species meets the three basic criteria for Survey and Manage, useful for the annual species review process (as described in Appendix F), and to update Management Recommendation and pre-disturbance Survey Protocol documents. For rare species, particularly those for which pre-disturbance surveys are not practical, strategic surveys are also the primary tool for finding new sites. For example, for species for which only two or three sites are known, strategic surveys can focus on the most likely habitat to find new sites. For rare species for which pre-disturbance surveys are not practical, the standards and guidelines place a high priority on strategic surveys so additional sites can be located and population status and long-term management needs determined before significant inadvertent loss of sites occurs.

Strategic surveys are not intended to replace pre-disturbance surveys. Because they are not focused on sites where management activities are planned, they cannot be expected to prevent the inadvertent loss of all sites. For species without pre-disturbance surveys, there is a higher level of risk than for species for which surveys are practical because no matter how quickly strategic surveys are completed, there is a risk of loss of undiscovered sites. An upper limit to this risk may be estimated based on the amount of late-successional forest expected to be disturbed during a given time period. The expected level or amount of such disturbance in the next decade is estimated and described in the Forest Ecosystem section later in this chapter. For any given species, loss of a small portion of its sites may not significantly increase risk. For an endemic species, an activity might disturb a substantial portion of its sites, but the odds of an activity affecting it at all are correspondingly lower. Alternatives 1 and 2 were designed assuming this is a reasonable level of risk, considering what is known about these species and given the limited opportunity and high cost of providing for lower risk. Alternative 3, by adding equivalent-effort surveys, lowers this risk somewhat when compared to Alternatives 1 and 2.

### **Effects Assumption Relating to the Potential for Reduced Funding**

Implementation costs of the Survey and Manage Standards and Guidelines described in the Costs of Management section in this chapter are higher than the amount the Agencies have been spending in the past. This raises a question regarding the likelihood of funding adequate to fully implement the selected alternative in the future. This, in turn, leads to a question of what will not be accomplished if funding is not adequate. The following factors provide confidence that these standards and guidelines will be conducted as described and the effects to species persistence will be consistent with the effects described in this chapter.

First, funding to implement these standards and guidelines is expected to increase in response to the better identification of requirements and benefits in the action alternatives. Clarification of objectives is one of the purposes of this SEIS. This discussion has already led to substantially increased funding for strategic surveys in fiscal year 2000.

Second, there are controls built into the standards and guidelines to prevent adverse effects to species if future funding levels are lower than expected. Activities that require pre-disturbance surveys will not be conducted unless those surveys are funded and completed. Where completion of strategic surveys is required before activities may be conducted in old growth, such activities will not take place until those surveys are completed. If the development of Management Recommendations that identify high-priority sites is not funded, the interim direction to manage all known sites will continue to apply. If strategic surveys are not completed, there would be little information to support moving a species to another category or removing it from Survey and Manage and existing management direction would continue to apply.

Finally, funding for pre-disturbance surveys usually arrives at the administrative unit as an unidentified part of funding for project planning. If projected funding levels, including funding for pre-disturbance surveys, are not obtained, the level of management activities, including those for timber harvest and ecosystem restoration activities, would be reduced. The magnitude of that effect may or may not be directly proportional to the total level of funding. For example, in Alternative 1, pre-disturbance surveys for timber sales are estimated to be \$11 per thousand board feet or about 7 percent of the total cost of sale preparation. If these funds are not included in sale preparation budgets, pre-disturbance surveys might simply be absorbed into existing funding levels and reduce the overall level of sale preparation work by the corresponding 7 percent. Conversely, some site-specific projects such as construction of recreation sites or certain restoration projects are dependent upon receiving funds for all required planning steps including necessary surveys. Failure to include funds to cover pre-disturbance surveys would prevent the entire project from being completed. The actual effect in both of these cases would depend on a variety of factors including the way funds are identified to activities, opportunities to adjust project size and location, and so forth. Attempting to further quantify all of these effects would require considerable speculation about funding levels for various types of management activities.

The efficiency of long-term funds for accomplishing forest management activities will also be affected by the funding and priorities placed on strategic surveys in the short term. First, strategic surveys are expected to improve knowledge of habitat associations and, therefore, better identify habitat needing surveys. Also, if strategic surveys can demonstrate that the most common species are adequately protected by reserves, they may be removed from Survey and Manage. In addition to focusing on certain rare categories given emphasis in the standards and guidelines, annual planning for strategic surveys will include careful consideration of the annual Species Review Process to determine where additional information might facilitate species removal from Survey and Manage or facilitate revising a Management Recommendation to describe high-priority sites.

For the above reasons, the effects of the alternatives displayed in this chapter are based on the assumption the standards and guidelines will be sufficiently funded to be implemented as described. If funding is less than anticipated or is stretched out over a longer time period, the beneficial effects to species would be either the same or greater than described. There could, however, be a reduction in timber harvest and other management activities.

### **Current Conditions, New Information, and Changed Circumstances Since 1994**

The analysis in this document is tiered to the Northwest Forest Plan Final SEIS and incorporates that analysis by reference. The management of natural resources and the analysis in the Northwest Forest Plan Final SEIS were surrounded by public and scientific controversy. The Northwest Forest Plan Final SEIS acknowledged this controversy and uncertainty. The public and scientific controversy concerning natural resource management in the Pacific Northwest has continued to the present time. Additionally, the amount of information available for description and analysis varies greatly by species and taxa for species or guilds managed under the Survey and Manage Standards and Guidelines. This unequal data is reflected in the discussions in this chapter. However, the key question in the use of the Northwest Forest Plan Final SEIS analysis is whether there is new information or changed circumstances since 1994, relevant to the environmental concerns and bearing on the actions or their impacts that would substantially alter the conclusions in the Northwest Forest Plan Final SEIS for species included in Survey and Manage and related standards and guidelines.

As forecast in the Draft SEIS, the Species Review Process was rerun between the release of the Draft SEIS and the preparation of the Final SEIS. New information was obtained from field units from 1999 pre-disturbance surveys and limited extensive and general regional surveys. This new information was used in the Species Review Process conducted in February and March 2000. For a more complete discussion, see Appendix F.

Although the effects analysis is incorporated by reference, this document repeats (for the benefit of the reader) various background information, analysis, and conclusions from the Northwest Forest Plan Final SEIS. The issue of substantial new information or changed circumstances is addressed for each resource in either general or specific terms, as appropriate. The adaptive management changes to the Survey and Manage and other mitigation measures proposed in the alternatives are based on new information. However, the new information related to these mitigation measures does not substantially alter the basic and overall conclusions of the Northwest Forest Plan Final SEIS such that the fundamental analysis in that document would be invalid.

The finding in this SEIS, which is based on a review of current information, is that there is no substantial new information or changed circumstances that would alter the overall impact analysis or conclusions of the Northwest Forest Plan Final SEIS. Implementation during the first 6 years indicates that accomplishments and progress are generally consistent with the underlying assumptions of the Northwest Forest Plan. The following overview addresses some of the basis for this conclusion.

## Overview of Aspects of Northwest Forest Plan Implementation

Late-Successional Reserve Assessments are required in the future prior to actions in Late-Successional Reserves. Late-Successional Reserve Assessments have been developed for nearly 6 million acres (more than 75 percent of Late-Successional Reserve acres).

Watershed analysis is required in Key Watersheds and Riparian Reserves prior to determining how proposed management actions meet the Aquatic Conservation Strategy. Approximately 80 percent of the Northwest Forest Plan area is currently covered by watershed analysis. Watershed restoration accomplishments include a net reduction of approximately 900 miles of roads in Key Watersheds. In addition, over \$150 million (consisting of 2,380 projects) has been invested in ecosystem restoration through the Jobs-In-The-Woods program. Watershed restoration is an active and productive part of the Northwest Forest Plan.

The area assumed available for timber harvest in the Northwest Forest Plan Final SEIS has declined approximately 13 percent as a result of corrections that more accurately reflect the extent of riparian and other reserves. The Probable Sale Quantity (PSQ) has declined 15 percent as a result of these corrections (see Timber Harvest section later in this chapter). These adjustments were consistent with the Northwest Forest Plan Final SEIS assumption that “Sustainable sale estimates will be revised using more refined data and procedures when Draft Forest and District plans are completed or current plans are revised.” (USDA, USDI 1994a, p. 3&4-263.)

All 10 Adaptive Management Areas, which encompass 1.5 million acres, have active research projects. Most of the Adaptive Management Areas have scheduled projects for timber harvest, forest health maintenance and improvement, and habitat and watershed restoration. Local citizen/scientist/manager partnerships have been formed for most of the Adaptive Management Areas. Plans have been completed for nine of the Adaptive Management Areas.

Regional implementation monitoring shows a high rate of success in implementing the Northwest Forest Plan Record of Decision. Over 95 percent compliance with the Northwest Forest Plan Record of Decision requirements has been found through monitoring of timber sales, roads, and restoration projects (USDA, USDI 1999c).

Although the area covered by the Northwest Forest Plan has experienced some wildfires, floods, and windstorms, none of these stochastic events are beyond the normal range of variability that was assumed in the Northwest Forest Plan Final SEIS.

The Northwest Forest Plan includes many long-term (100 years or longer) goals and objectives. Conclusions based on a brief assessment of the overall plan (6 years of implementation) must be limited. Based on monitoring information and the implementation experience described above, it is possible to conclude that the Final SEIS assumptions relating to the existing environment and effects of implementing the Northwest Forest Plan remain valid. Therefore, the Northwest Forest Plan Final SEIS assumptions and conclusions are used as a basis for the effects analysis in this SEIS.

## Aquatic Ecosystem

### Background and Affected Environment

The Northwest Forest Plan provides for a high level of protection for all streams, lakes, and wetlands on National Forest and BLM managed lands within the Northwest Forest Plan area. The Aquatic Conservation Strategy is a habitat-based approach developed to restore and maintain ecological health of watersheds and the aquatic ecosystems contained within them on these federally managed lands (USDA, USDI 1994a and USDA, USDI 1994b). The key assumption of the Aquatic Conservation Strategy in the Northwest Forest Plan was that species-specific strategies

would be insufficient to maintain and recover the populations of aquatic-dependent species. The Northwest Forest Plan Record of Decision emphasized this concept by stating:

*“Any species-specific strategy aimed at defining explicit standards for habitat elements would be insufficient for protecting even the targeted species. The Aquatic Conservation Strategy must strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitats.”* (USDA, USDI 1994b, p. B-9)

The four major components of the Aquatic Conservation Strategy (Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration) provide the basis for protection of aquatic-dependent and full-time and part-time riparian-dependent flora and fauna. Species that spend their entire life histories in water receive the highest degree of protection on federally managed lands, as they are all contained within Riparian Reserves. Managing Riparian Reserves under the specific standards and guidelines, combined with the other components of the Aquatic Conservation Strategy, should meet the habitat/life history needs of the water-dependent flora and fauna throughout the Northwest Forest Plan area. Riparian Reserves also benefit species that spend considerable portions of their life histories within the water or within riparian areas.

Alternative 9 in the Northwest Forest Plan Final SEIS incorporated Riparian Reserve Scenario 1, which increased the width from one-half site potential tree height or 50 feet, to one-site potential tree height or 100 feet, whichever is greatest, on each side of intermittent streams. This change was due to the additional species analysis and response to public and internal comments in the Northwest Forest Plan Final SEIS. The analysis in the Northwest Forest Plan Final SEIS underestimated the potential landscape level of protection provided by the Aquatic Conservation Strategy. The quantity of Riparian Reserve acres is higher than originally analyzed, and the amount of land within all Reserves has increased from a 6:1 ratio of reserve to non-reserve lands in the Northwest Forest Plan Final SEIS to a 7:1 ratio. This higher acreage has resulted in a 15 percent decrease in PSQ when compared to that anticipated in the Northwest Forest Plan Final SEIS. The absolute increase in reserves is in addition to the increase in prescribed Riparian Reserve widths identified in the Northwest Forest Plan Record of Decision. The assumptions of the Aquatic Conservation Strategy, the analysis contained in the Final SEIS, and the Northwest Forest Plan Record of Decision remain valid after 6 years of implementation.

All forests within the Northwest Forest Plan area were subjected to intense floods in 1996 and again in 1997. The most intense storms (estimated to exceed 100-year events) occurred on National Forests on the west side of the Cascade Range (McCammon 1999, pers. comm.). The floods affected many streams and watersheds within the Northwest Forest Plan area. Within the flood-affected watersheds, the effects were dispersed and occurred in clumps. Some subwatersheds received extensive flood damage, whereas neighboring subwatersheds may have experienced little to no effect. The aquatic system of some watersheds may have benefitted from the floods (McCammon 1999, pers. comm.). For example, the Clackamas River basin on the Mt. Hood National Forest had highly different responses to the floods depending on the watershed. The upper Clackamas Watershed had less than 10 identified landslides, whereas the Fish Creek watershed had more than 250 landslides. These two watersheds are less than 20 miles apart. Although the flood affected many streams across the planning area, many streams and watersheds remained intact. The pattern of flood effects affirms the integrity of the landscape-level approach and assumptions of the Aquatic Conservation Strategy and the Northwest Forest Plan Final SEIS.

Sixteen species of fish occurring within the Northwest Forest Plan area have been listed under the Endangered Species Act since the Northwest Forest Plan ROD was signed. Three additional fish species have been proposed for listing (see Table 3&4-1 at the end of this chapter). Fourteen of the 16 species are anadromous fish; the two bull trout Distinct Population Segments are resident species.

These listings do not reflect the integrity of the Aquatic Conservation Strategy. The Northwest Forest Plan anticipated the potential of these listings and adopted a strategy to assist in the long-

term recovery of the species. Factors other than the habitat and land uses contributed to the need to list these species. Anadromous fish spend the majority of their life histories in areas outside of the federally managed lands covered by the Northwest Forest Plan. Other mortality factors (commercial and recreational fish harvest, ocean conditions, etc.) contributed to the listing of the fish. The relative contribution of each mortality factor was not identified in the listing announcements. The Northwest Forest Plan Final SEIS states that:

*“...the [Aquatic Conservation] strategy can succeed at maintaining and restoring the aquatic and riparian habitats regardless of what happens on nonfederal lands, but that would not ensure population viability of many of the fish stocks evaluated in this SEIS. For these reasons, it is not possible to determine whether any of the alternatives in this SEIS would preclude listing of fish species under the Endangered Species Act.” (USDA, USDI 1994a, p. 3&4-202.)*

The Aquatic Conservation Strategy has been in place for approximately 6 years, a time period too short for the Aquatic Conservation Strategy to demonstrate a measurable improvement in habitat conditions for fish populations to respond to the improved conditions. This, too, is consistent with the analysis contained in the Northwest Forest Plan Final SEIS and FEMAT Report. The authors of the Aquatic Conservation Strategy (USDA et al. 1993) stated that:

*“We emphasize, however, that it will require time for this strategy to work. Because it is based on natural disturbance processes, it may take decades to over a century to accomplish all of its objectives.”*

Implementing the Aquatic Conservation Strategy for 6 years has not affected the listings of water quality impaired stream segments under section 303(d) of the Clean Water Act. Although the number of stream miles added to the 303(d) list in Oregon increased from approximately 12,000 miles from the time period of 1994-1996, to approximately 13,700 miles in 1998 (Oregon Department of Environmental Quality 1999), not all of these streams occur within the Northwest Forest Plan area. The increase in stream miles is due primarily to more information being available and a greater emphasis on water quality matters in recent years. For example, Oregon Governor John Kitzhaber initiated a statewide effort aimed at recovering declining fish stocks. The Governor’s effort involves identifying water quality impaired water bodies and developing Water Quality Recovery Plans to address factors that contribute to the listing of the water body under section 303(d). The Northwest Forest Plan recognized these water quality problems prior to their listing under 303(d). These listings are not new information for the Northwest Forest Plan.

## Environmental Consequences and Comparison of Alternatives

The Aquatic Conservation Strategy emphasizes restoring watersheds, ecosystem functions, and aquatic systems, which results in a high degree of protection for aquatic-dependent flora and fauna regardless of the alternative selected. The Riparian Reserve network is designed to protect and restore functions and processes of an interconnected network of aquatic systems (USDA, USDI 1994b). The Northwest Forest Plan Record of Decision requires Riparian Reserve widths that maintain the functions and processes that support the particular aquatic community and associated riparian area. Watershed analyses address the factors that affect the protection and restoration of the habitat type affected (such as a lake or wetland) and recommend Riparian Reserve management designed to protect and restore the functions and processes necessary to support the habitat type. The Riparian Reserve widths applied through project-level NEPA decision documents are based on these watershed analyses.

Regardless of the understanding of the ecological needs of aquatic-dependent flora and fauna or their existing distribution, the Aquatic Conservation Strategy provides a high degree of protection of their habitat. The risk to the persistence of a particular species depends on its distribution and life history characteristics. Species that have very limited distribution throughout their known range and/or occur in rare or isolated habitats (wetlands, lakes, geothermal springs, isolated seeps,

etc.) are generally at higher risk than more widely distributed species and/or species that utilize a broader range of habitat conditions.

The degree of dependence on water also is a risk factor. Species that spend their entire lives within water generally have a lower risk of long-term negative effects due to habitat-disturbing activities. Species that spend greater proportions of their life histories out of water and within Riparian Reserves have a somewhat higher risk to their persistence than purely aquatic species, but they have a relatively lower risk to their persistence than species that commonly use areas outside of Riparian Reserves (see Van Dyke's salamander, Amphibians section in this chapter). The other components of the Northwest Forest Plan, such as Late-Successional Reserves and Administratively Withdrawn Areas, provide other levels of protection for those species that spend more time outside Riparian Reserves (a discussion of risks to terrestrial species associated with late-successional forests is presented in the Forest Ecosystem section).

All alternatives, including the No-Action Alternative, include measures to reduce the risk to aquatic-dependent flora and fauna at the site scale. The three action alternatives provide immeasurable benefits to the restoration of functions and processes for aquatic ecosystems in the Northwest Forest Plan area. The degree of protection provided by the three action alternatives is in addition to the "universal protection" provided by the Aquatic Conservation Strategy. The Survey and Manage direction in the alternatives provides mechanisms to collect additional information (such as through strategic surveys) to develop and refine Management Recommendations. The species-specific Management Recommendations would complement the goals of the Aquatic Conservation Strategy.

For isolated populations of aquatic-dependent Survey and Manage species known to occur only in a few locales, the action alternatives provide for refining Management Recommendations that specifically address the habitat needs of the species at their known sites. This provision serves to emphasize the importance of some isolated habitats. Refining the species-specific Management Recommendations would help prioritize restoration efforts. The Aquatic Conservation Strategy provides for a high degree of persistence for species that may be locally rare, but have a wide distribution. Species that occur only in a few locales would be at a slightly increased risk to their persistence, compared to widely distributed aquatic species, from habitat-disturbing activities under the Aquatic Conservation Strategy. Even though there could be effects at the site scale, application of the Aquatic Conservation Strategy would yield functioning riparian and aquatic ecosystems over time in the Northwest Forest Plan area. Thus, the Aquatic Conservation Strategy provides a reasonable assurance of persistence of all aquatic-dependent species in the Northwest Forest Plan area.

None of the alternatives affect the analysis or outcomes developed in the Northwest Forest Plan Final SEIS and implemented through its Record of Decision (USDA, USDI 1994b).

The amount of land projected to be managed as known sites for Survey and Manage species in 25 years is discussed in the Timber Harvest section. Although the acres vary by alternative, the benefits to aquatic species is not expected to change the outcomes described in the Northwest Forest Plan Final SEIS. This is due to the fact that the Aquatic Conservation Strategy provides a high level of protection to aquatic habitats and associated species regardless of the presence of known sites for Survey and Manage species. Although the projected acreage of managed sites varies across the alternatives, the benefits to aquatic species is not measureable and would not alter the conclusions reached in the Northwest Forest Plan Final SEIS. The one exception to this statement would be for species that live primarily in wetlands less than 1-acre. The managed area for Survey and Manage species that contributes to additional protection for the wetlands less than 1-acre would provide additional benefits to the Survey and Manage species and other species that inhabit the affected wetland. As discussed above, these benefits would accrue primarily at the site scale versus the scale of the Northwest Forest Plan and would not alter the conclusions reached in the Northwest Forest Plan Final SEIS.



Regardless of the alternative, the Survey and Manage strategies (manage known sites, manage high-priority sites, etc.) do not change the assessment outcomes towards achieving the Aquatic Conservation Strategy goals described in the Final SEIS. The effectiveness of the Aquatic Conservation Strategy in achieving its goals is independent of whether managed sites are added in the future or currently managed sites are removed from the Survey and Manage category. The goal of the Aquatic Conservation Strategy is to restore the functions and processes to maintain the ecological health of watersheds and aquatic ecosystems. The four components (Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration) were determined to effectively achieve the overall goal independent of the Survey and Manage strategies. The Aquatic Conservation Strategy applied through the Northwest Forest Plan ROD resulted in an 80 percent or higher likelihood of providing sufficient aquatic habitat to support stable, well-distributed populations of the seven races/species and groups of salmonids. Similarly, the Aquatic Conservation Strategy provides a high probability for aquatic species persistence as defined in Chapter 2.

## **Forest Ecosystem**

### **Background and Affected Environment**

#### **Analysis Scale and Ecosystem Variability**

The Northwest Forest Plan is an ecosystem approach to land management that focuses on habitat for late-successional and old-growth forest related species. The planning area is limited to the Forest Service and BLM administered lands within the range of the northern spotted owl.

Although the scale of the Northwest Forest Plan is regional, the Northwest Forest Plan uses watershed scale analysis and site-specific analysis for local actions. The Northwest Forest Plan brings consistency to analyses, yet recognizes that some local, site-specific projects may have short-term adverse effects. Traditional temporal planning scales have been expanded from decades to centuries (100-200 years) in recognition that ecosystems are adapted to natural disturbance processes and climatic fluctuations that alter habitat. Although these natural extremes have short-term adverse effects, they foster the diversity and resilience of species and ecosystems in the long term. The period since adoption of the Northwest Forest Plan in 1994 represents approximately 3 percent of the projected natural cycle of 100 to 200 years.

The Northwest Forest Plan features a functional, interconnected, late-successional forest ecosystem to provide dispersal (short term) and movement between reserves (long term) of species, both of which are essential processes for selection, adaptation, and evolution. As such, the major focus is on function, rather than structure or composition, giving a relatively “coarse” approach. The processes of succession and disturbance are expected to maintain a diversity of landscape patterns across the region. Management of habitat at this scale, including the provisions for Late-Successional and Riparian Reserves, and Aquatic Conservation Strategy objectives, are expected to meet the needs of late-successional forest associated species.

Since managing habitat at a large scale does not completely ensure persistence of all species, certain standards and guidelines, parts of the Aquatic Conservation Strategy, and some mitigation measures including Survey and Manage, focus on providing stand-scale habitat, such as clumps of green trees, snags, and woody habitat across the landscape. These mitigation measures are a “fine filter” approach, focusing on habitat needs of some individual species.

The Northwest Forest Plan and this SEIS assume a continuation of succession and the disturbance processes that interrupt succession. Other assumptions used in this SEIS include the natural variability in successional process rates and successional directions. Since climate drives successional rates, there is an expected variability in rate and direction associated with normal climatic variability. These assumptions remain the same regardless of the alternative chosen. Like

the weather, succession is roughly predictable, but imprecise. Although disturbance regimes (high rates of change) are often described precisely in terms of frequency, intensity, duration, and extent, such regimes are also highly variable. For example, the average fire return interval in the temperate forests of Oregon vary from less than 10 years between fires at the low elevation, drier habitat to over 100 years between fires in the high elevation, more moist habitats. (Variability throughout the overall region is greater yet.) These frequencies seem precise, but standard deviations (variability associated with the average) are often greater than the average. This means that average conditions and average rates of change can only be approximated. Given that natural variability is wide, chaotic, and takes at least several decades to establish patterns and trends, it is premature to effectively evaluate human-caused effects and trends. Therefore, any analysis of the validity of the Northwest Forest Plan based on only the first 6 years of its implementation is limited in the ability to draw definite conclusions. Moreover, variation associated with implementation of the various alternatives is likely to be insignificant when compared to the effects of successional and disturbance processes.

## **Late-Successional and Old-Growth Forests**

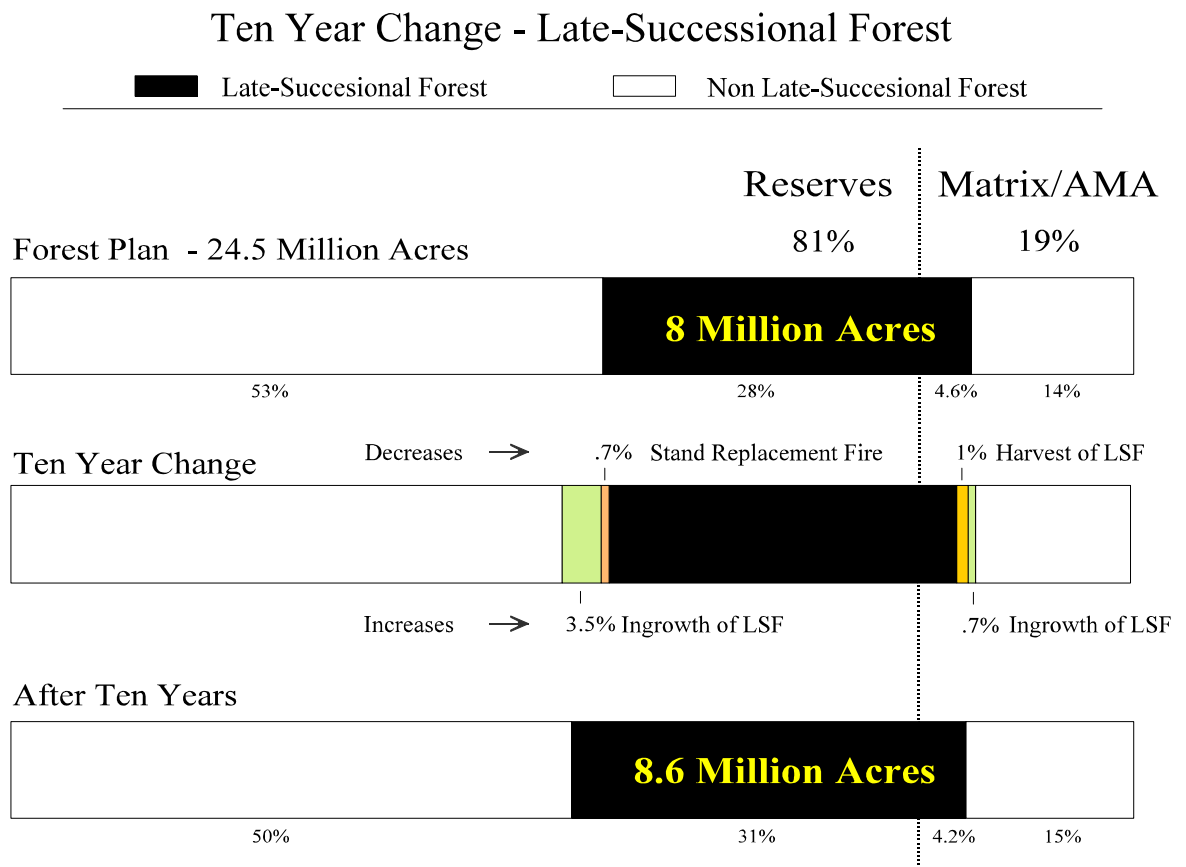
Within the context of the Northwest Forest Plan, late-seral stage stands (such as late-successional and old-growth forests) typically begin between 80 and 140 years, depending on site conditions and stand history (USDA, USDI 1994b, p. B-3). The Northwest Forest Plan anticipated and planned for increases in late-seral acres in the long term, as well as short-term harvest of late-successional stands in the Matrix and Adaptive Management Areas. Although previous and current inventories are not specific enough to measure increases in late-seral acres since adoption of the Northwest Forest Plan due to the short time period involved, the acres in various age groups can be estimated. From this, it is possible to predict an average annual amount of ingrowth (growth from mid to late-successional), and express it in terms of the current decade.

A total of approximately 8 million acres of late-successional forest is within the Northwest Forest Plan area. As shown in Figure 3&4-2 below, approximately 81 percent of the Northwest Forest Plan area (and 86 percent of the currently existing late-successional forest) is in reserves, while 19 percent is in Matrix or Adaptive Management Areas and contribute to PSQ (timber harvest). In the next decade, regeneration or partial timber harvest in late-successional forests are predicted to modify or convert about 1 percent of the Northwest Forest Plan area (or about 3 percent of the total late-successional forest)(see Timber Harvest section in this chapter) and approximately 0.7 percent may be impacted by stand-replacement wildfires (although the natural variability around these numbers is substantial).

Since 1994, harvest levels have been at least 20 percent lower than anticipated in the Northwest Forest Plan Final SEIS (see the Timber Harvest section in this chapter). PSQ has been adjusted downward by approximately 15 percent to more accurately reflect the extent of Riparian Reserves, based on new information available since 1994. In relation to long-term and regional ecological objectives, these changes or changes between the alternatives are not expected to be meaningful because of the large extent of reserves and the large range of natural variability. Although late-successional and old-growth forests will not be replaced in the Matrix land allocation, across the entire Northwest Forest Plan area and in the long term, late-successional and old-growth forest is anticipated to be replaced at a rate four times greater than the rate at which it is currently harvested. As a result, in the long term, there will be more acres of late-successional and old-growth forests in the Northwest Forest Plan area than currently exists. This late-successional and old-growth forest will exist in the reserves and Administratively Withdrawn land allocations (USDA, USDI 1994a, pp. 3&4-42 through 46).

## **Species Population Numbers and Composition**

New information has been derived from the surveys conducted prior to ground-disturbing activities as required by the current Survey and Manage Standards and Guidelines. This new information includes increased knowledge of population numbers and the extent of species range (see Tables F-1 and F-2 in Appendix F). Although range-wide data on the status of many species



**Figure 3&4-2.** Distribution of late-successional forest to reserve land allocations and Matrix, and predicted modification and ingrowth, first decade.

is scarce, some of the new information does indicate that certain species occur in greater numbers and in different areas than was previously known. New information concerning individual species is the basis for the adaptive management changes proposed for managing species in the action alternatives. This new information concerning species numbers and composition does not change the overall and basic conclusions of the Northwest Forest Plan Final SEIS relative to forest ecosystems.

## Global Climate

The effects of the Northwest Forest Plan on global climate were analyzed in the Northwest Forest Plan Final SEIS. Global warming may be the result of increases in atmospheric carbon dioxide, methane, nitrous oxide, and other trace gases attributed to human activities. Land management activities, such as prescribed burning, could affect the quantity of carbon dioxide released into the atmosphere. Conversely, reforestation is a pathway to sequester carbon. The Northwest Forest Plan Final SEIS analysis concluded that the impacts of the Northwest Forest Plan on global atmospheric carbon dioxide balance would be much less than 0.01 percent of the total. Under all alternatives presented in this SEIS, the impact on atmospheric carbon dioxide would be less than anticipated in the Northwest Forest Plan Final SEIS because of lower harvest levels than originally expected.

## Natural Disturbance Processes

There was no estimate made in the Northwest Forest Plan Final SEIS of the amount of natural disturbances for short intervals such as 1994 to 2000. Because of the short-term nature of the

information in those 6 years and because of the high variability of natural disturbances, an examination of data from this period would not lend itself to valid comparison of the analysis in the Final SEIS. There is no new information since 1994 concerning natural disturbances that would alter the assumptions, impact analysis, or conclusions of the Northwest Forest Plan Final SEIS concerning natural disturbance processes.

The equilibrium level of late-successional forests will depend, in part, on the ability to limit stand-replacement wildfires. The long-term estimates of late-successional forests described in the Northwest Forest Plan SEIS are based on fire suppression abilities increasing the return interval for stand-replacing events from the estimated natural (average) rate of every 250 to 400 years. To the extent the various alternatives affect the ability to control fire, particularly in late-successional and other reserves where most of the late-successional forest is expected to be, the ultimate amount of late-successional forest in the long-term may be affected. Fire modeling done as part of Late-Successional Reserve Assessments in the eastside and southern provinces of the Northwest Forest Plan area indicate late-successional acres will not increase at all with a passive fire management strategy.

### **Human Activity**

The PSQ has declined approximately 15 percent to 811 million board feet (MMBF) compared to the PSQ of 958 MMBF anticipated in the Northwest Forest Plan Final SEIS. The level of prescribed fires was not quantified in the Northwest Forest Plan Final SEIS. However, this activity has occurred at the approximate level normally associated with the harvest and restoration activities that have occurred in the past 6 years. The rate of road and stream restoration was also not quantified in the Northwest Forest Plan Final SEIS; however, these activities have also occurred at a level that is reasonable to expect. All of these activities in the initial 6-year period of the implementation of the Northwest Forest Plan have been consistent with its assumptions, impact analysis, and conclusions.

Overall, changes that have occurred since 1994 were anticipated. The most important change is the trend towards managing for individual species, rather than functional processes. Attempting to maintain stable populations on a site-by-site basis will continue to spotlight conflicts in species needs and the natural ebb and flow in numbers. Late-successional forest related species have different habitat needs and have survived various types and intensities of disturbance. Disturbance and change enhance long-term resilience. Species diversity may be best served by restoring the focus to maintaining functional groups and processes.

### **Assessing Ecological or Species Risk**

The four essential elements of risk are: value, susceptibility, hazard, and exposure. Removing any of the four elements results in eliminating risk. Altering any element (risk management) alters the risk landscape (USDA, USDI 1997a). Although values cannot always be expressed economically, they still exist. Hazard is considered to have a negative effect on the valued resource, yet nature depends on hazards to keep it healthy. Examples may be extreme, and include acute climatic events, fires, floods, or insect outbreaks.

Succession (which consists of slow chronic change) and disturbance (which consists of acute change) produce "winners" (individuals within a species that are enhanced by disturbance) and "losers" (individuals within a species that are killed or left at a competitive disadvantage), resulting in landscape diversity through their differing rates of change. In many instances, susceptibility may be related to intensity of exposure to one or more hazards over time and space. However, if the resource is not susceptible to the hazard, there is no risk. The probability of exposure to a specified hazard is commonly considered risk.

Information about the exact habitat requirements of many organisms does not exist, nor is it possible to accurately predict the exact consequences of each potential land management activity for all species (USDA, USDI 1994a, p. 3&4-122). The greater the uncertainty, the more difficult it

is to manage risk. However, through acquisition and application of knowledge about ecosystems or species, and their probable exposure and susceptibility to known hazards, it is possible to devise strategies to manage the risk or probability of an outcome.

The challenge is to manage the elements of risk to provide a reasonable assurance of persistence (see Chapter 2). Each species has its value, and value within a watershed or site can be additive to a certain point. The hazards may be the lack of measurable elements of habitat. Each species has its own specific requirements (unless functional groups are considered). Also, each species' susceptibility associated with the hazard is unique. The Northwest Forest Plan Standards and Guidelines attempt to manage the components of late-successional and old-growth condition, or maintain late-successional and old-growth habitat to reduce exposure to the lack of late-successional and old-growth structure. Management under the Northwest Forest Plan (including the Survey and Manage Standards and Guidelines) has provided specific habitat components or habitat areas (land allocations) to meet those needs.

In considering effects of the alternatives, it is important to be aware of some principles of ecosystem management. Among those principles important to an overall understanding of the effects analysis are the following:

- Management of forest ecosystems does not control regional climatic or other ecosystem processes to a great degree.
- The population extent and density of species will vary without an understanding of the cause.
- Reduction in exposure is not linearly related to effort or resource input. Usually, initial efforts result in greater reduction in risk. Later efforts tend to be more expensive, but less productive.
- Information gathering aimed at managing risk must be focused specifically at management questions regarding species needs. To achieve the objectives of persistence, information must provide the answer to questions of susceptibility, hazard, or exposure.
- Management aimed at dampening extreme ecological variations caused by natural disturbance, such as fire, tends to lead to eventual magnification of the effects associated with disturbance.

## **Environmental Consequences and Comparison of Alternatives**

The overall strategy for the Northwest Forest Plan is restoring and maintaining functional late-successional and old-growth forest ecosystems. The species-specific direction of the Survey and Manage Standards and Guidelines may sometimes conflict with management associated with the core strategy of the Northwest Forest Plan. An example of this potential conflict would be the use of prescribed burning, or allowing natural fire, to restore ecological functions to fire-associated forests in southern Oregon or northern California. There may be situations where Survey and Manage species depend on habitat that results from exclusion of fire from the ecosystem. These potential conflicts between the species-specific approach of Survey and Manage and the management of broad ecological functions important for maintaining late-successional forest ecosystems may lead to at least short-term management that varies with that needed to maintain natural disturbance.

Implementing Survey and Manage Standards and Guidelines during the initial 6 years of the Northwest Forest Plan has generated new information concerning species. Additional new information (developed through Survey and Manage strategic surveys concerning species ecology and species ability to persist in the presence of natural disturbance) would be expected to resolve

these potential management conflicts in the long term. Because these conflicts would be short term and within the expected variability of natural disturbance, there would be no prominent adverse ecological effects.

In the long term, no substantial cumulative change is anticipated in the overall functioning of succession or disturbance as a result of implementing the proposed action or any other action alternative. Each alternative provides specific instructions for Survey and Manage species; however, from an overall ecosystem perspective, the effects associated with Survey and Manage Standards and Guidelines do not vary substantially under the four alternatives. The Northwest Forest Plan Final SEIS concluded that the acres associated with the Survey and Manage mitigation measures would have a relatively minor effect on maintenance of a functional and interconnected, late-successional forest ecosystem (USDA, USDI 1994a, p. 3&4-39). Although the number of acres associated with Survey and Manage under all alternatives is greater than was anticipated (tens of thousands of acres), these acres are minor in relation to the approximately 20 million acres of reserves under the Northwest Forest Plan, and therefore would not alter the conclusions in the Northwest Forest Plan Final SEIS. If the ability to conduct prescribed fires varies substantially between alternatives as described in the Wildland and Prescribed Fire section in this chapter, there could be a noticeable effect in the amount of late-successional forest in the long-term, particularly in the eastside and southern provinces. Standards and guidelines that permit certain wildland fires for resource benefits without pre-disturbance surveys, and Management Recommendations that allow some prescribed fires in known sites, could mitigate this effect.

## **Air Quality, Water Quality, and Soil Productivity**

### **Background and Affected Environment**

Implementation of the Northwest Forest Plan Standards and Guidelines for air quality, water quality, and soil productivity have started to improve the general ecosystem health, as well as the management of habitat for late-successional and old-growth forest related species. However, 6 years is a short time for evidential change. Additional time and, in some cases, increased management activities are necessary to fully reach the intended goals of the Northwest Forest Plan.

The reduction of timber harvest levels in the Northwest Forest Plan area, along with alterations in timber harvest methods, have reduced management activity impacts to water quality and soil productivity on federally managed lands since the Northwest Forest Plan Record of Decision was signed. Road closures and road obliteration activities are increasing in the Northwest Forest Plan area. In Key Watersheds, for instance, there has been a net reduction of approximately 900 miles of roads. Other activities designed to enhance long-term air quality, water quality, and soil productivity have also been accomplished. These activities include: subsoiling, fuel treatment, upland watershed restoration, riparian restoration, and a vigorous program of replacing undersized culverts to comply with the standards and guidelines. Approximately 2,380 ecosystem restoration projects have been accomplished through the Jobs-In-The-Woods program, at a cost of over \$150 million.

Other laws, regulations, and guidelines adopted since 1994 have helped to improve management of air, water, and soil in the Northwest Forest Plan area. New listings under the Endangered Species Act, Clean Air Act amendments, Clean Water Act supplements, and updated State requirements for water and air quality all complement the principles of the Northwest Forest Plan. In addition to new mandatory requirements, other voluntary actions have been applied to improve ecosystem health. For example, in southwest Oregon a voluntary arrangement has been established with the Oregon Department of Environmental Quality to monitor air quality and restrict prescribed burning when air quality thresholds are exceeded.

Flooding occurred in western Washington and Oregon in 1996 and 1997, resulting in a mix of conditions. Some hydrologic systems were enhanced through introduction of wood and debris, and floodplain alteration; other systems were degraded due to loss of channel structure. These flood events have been followed by an active program of stream restoration to repair damage.

The Northwest Forest Plan and Aquatic Conservation Strategy provide an unprecedented level of protection for aquatic systems and water quality. Based on the results of implementation monitoring, there has been good to excellent implementation of the Aquatic Conservation Strategy throughout federally managed lands in the Northwest Forest Plan area (USDA, USDI 1999c).

Water Quality Recovery Plans are being developed to respond to degraded water quality conditions as part of conformance with section 303(d) of the Clean Water Act. Soil quality is protected through agency standards, application of Best Management Practices as prescribed by the Clean Water Act, as well as the Northwest Forest Plan and its Aquatic Conservation Strategy objectives. Watershed conditions and functions are protected or restored based on priority, activities identified through watershed analysis, water quality recovery plans (Clean Water Act), and/or consultation with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

There have been changes in air quality since 1994 in the area covered by the Northwest Forest Plan. Smoke generated from burning slash in forest management activities has declined commensurately with the decline of timber harvesting. Conversely, there has been an increase in prescribed burning for ecological health and to reintroduce fire into fire-dependent ecosystems. Slash from forest management activities tends to include heavier fuel loadings, and therefore, generates greater volumes of smoke than natural slash burned for ecological reasons. However, the overall impact to airsheds has been a decline in smoke generated from prescribed burning by the Agencies.

There has been an increase in prescribed burning of slash from forest management activities on private lands adjacent to federally managed lands covered by the Northwest Forest Plan. Population increases, with their associated transportation and infrastructure needs, have also increased emissions (particularly nitrogen and ozone). Sulfur emissions, on the other hand, have decreased and are expected to continue decreasing due to technological advances in emission control systems and the gradual switch to natural gas as a fuel of choice.

## **Environmental Consequences and Comparison of Alternatives**

All alternatives have the potential, in the short term, to delay or eliminate management activities beneficial to air, water, or soil resources, due to conflicts caused by survey requirements and management of known sites. Affected actions could include subsoiling, fuel treatment, upland watershed restoration, and riparian restoration treatments. The potential for short-term conflicts with these management activities would be greater under the No-Action Alternative and Alternative 3, than under Alternatives 1 and 2 because of the larger number of species protected under the No-Action Alternative and the requirement for a larger number of surveys and the management of larger known sites under Alternative 3.

Under all alternatives, in the long term, these conflicts are expected to be reduced or resolved through the adaptive management use of increased knowledge gained through strategic surveys. The action alternatives, through the use of strategic surveys, would generate increased knowledge more quickly than the No-Action Alternative. Under all alternatives, the effects of potential conflicts of Survey and Manage Standards and Guidelines with management activities beneficial to air, water, or soil resources would be minor in the short term and inconsequential in the long term. This analysis is based on the relatively small amount of acres (tens of thousands) associated with Survey and Manage direction compared to the 24.4 million acres of federally managed lands within the Northwest Forest Plan area (Figure 3&4-2).

# Wildland and Prescribed Fire

## Background and Affected Environment

Extreme wildfire conditions produced corresponding increases in acres burned in 1994, 1996, and 1999. Conversely, very few wildfire acres burned in 1997 and 1998 when moderate-to-low wildfire conditions existed. The Northwest Forest Plan Record of Decision was released in 1994, during one of the most devastating wildfire years experienced in the west. The 1994 fire season was pivotal not only because of the loss of life but because it was one of the most expensive fire seasons on record.

While wildfire events and burned acres have not exceeded the normal range of variability assumed in the Northwest Forest Plan Final SEIS, there are many examples of recent wildfire impacts to reserve land allocations in the Northwest Forest Plan area. The 1994 Dillon fire on the Klamath National Forest affected over 27,000 acres of a key watershed identified in the Northwest Forest Plan. Eighteen percent of the Dillon fire burned in the severe category, while only 2 percent of the Late-Successional Reserve burned severely. Wildfire on the Wenatchee National Forest burned over 185,000 acres in 1994. Twenty-eight percent burned in the lethal category (i.e. greater than 70 percent mortality). Ninety percent of one of the Late-Successional Reserves burned with such severity it was deemed no longer viable (Keleman 2000, pers. comm.). In 1999, the Big Bar Complex on the Shasta-Trinity and Six Rivers National Forests burned over 140,000 acres, most of this in Wilderness and Late-Successional Reserves. The area burned on the Six Rivers National Forest was 59,220 acres; 30 percent was classified as lethal. In the Six Rivers National Forest's portion of the Megram fire, 35,891 acres burned was in Late-Successional Reserve; 24 percent was classified as high severity burn (Salazar 2000, pers. comm.). The High Complex on the Shasta-Trinity National Forest burned 3,800 acres of a Late-Successional Reserve. Thirty-seven percent of this Late-Successional Reserve was classified as burning in the high severity range.

FEMAT, in the Ecological Processes section, discusses the role of fire throughout the entire Northwest Forest Plan area. FEMAT highlighted the role of fire in maintaining the ecosystems of the Eastern Cascades of Washington and Oregon, the California Cascades, and the California and Oregon Klamath Provinces. The Oregon Coast Range was also recognized for the previous role of fire in establishing the mosaic across the landscape. There is a discussion on the role fire played in the coastal Douglas-fir forests. Fire suppression efforts have made these provinces more susceptible to catastrophic wildfire and epidemic attacks of insects and disease, and any planning effort for the protection of late-successional and old-growth forests must include a fire management assessment to help assure the stability of the stands.

Prescribed fire, proclaimed important in drier, high fire frequency regimes by FEMAT and the Northwest Forest Plan Final SEIS, and other fuel reduction methods to restore ecosystem health, can potentially conflict with the management of known sites under the Survey and Manage Standards and Guidelines. Without the reduction of hazardous fuels that have built up as a result of fire exclusion, these same known sites may be inadvertently lost to wildfires. Preliminary conclusions of a study of fire effects on mollusks currently being conducted on the Klamath National Forest are that there is little statistical negative relationship between fire and mollusk presence (Agee 2000, in prep). Recent patchy underburns had slightly higher mollusk presence.

The following excerpts from the Northwest Forest Plan Final SEIS address hazardous fuels:

*“Interruption of natural fire regimes has a direct effect on ecosystem species composition, and sometimes on species persistence. The near exclusion of natural, low to-moderate intensity wildfire has resulted in a proliferation of fire-intolerant and shade-tolerant species (i.e., true fir species and hardwoods), which are replacing ponderosa pine and Douglas-fir forest types within the dry provinces. Changes in long term soil productivity, stand structure and function, forest health, and biological diversity are also occurring due to the exclusion*



*of fire. The mortality of trees due to insects and disease makes forests more susceptible to high-intensity, stand-replacing fires.” (USDA, USDI 1994a, p. 3&4-83.)*

*“Silvicultural practices to enhance stand development may reduce the risk of high severity wildfires. Underburning reduces the amount of fuel...Wildfires in underburned stands are generally less severe, consequently less intrusive fire suppression methods may be effective. Underburning should be reintroduced across large areas over a period of time to create a mosaic of stand conditions. Silvicultural treatments to reduce wildfire risk may include thinning, underburning, and establishing fuelbreaks.” (USDA, USDI 1994a, p. 3&4-84.)*

*“The goal of wildfire hazard reduction is to modify fuel profiles in order to lower the potential of fire ignition and the rate of spread. Hazard reduction will also protect and support land allocation objectives by lowering the risk of high intensity, stand-replacing wildfires...Hazard reduction activities will include, but not be limited to: prescribed burning, mechanical or manual manipulation of forest vegetation and debris; removal of forest vegetation and debris; as well as combinations of these methods. While fuelbreak construction and underburning are both valid hazard reduction techniques, prescribed burning is generally more effective in reducing wildfire hazard.” (USDA, USDI 1994a, Appendix B, p. B-135.)*

Appendix E of the Recovery Plan for the Northern Spotted Owl – Final Draft (USDI 1992), FEMAT, and other supporting documents to the Northwest Forest Plan ROD, explain the role of fire and encourage the use of prescribed fire. FEMAT recognized that a strategy of large-scale underburning in the drier east and south provinces should be considered. It encourages thinning in plantations in the moist provinces to reduce the threat of loss by wildfire and concludes by saying that initial attack and detection should be the primary emphases in these wetter environments.

Condition class is defined as the spacing and accumulation of vegetation with an assessment of fire caused mortality. Fire frequency, or return interval, refers to the interval within which fire historically burned across a landscape. There are currently over 1.3 million acres, or 19 percent, of the Late-Successional Reserve land base in Condition Class 3 in the frequent fire return interval category. Class 3 is characterized by conditions leading to stand-replacement fire and consumption of the soil organic layer (USDA FS 1999c). A Condition Class 3 in a fire frequency of 0 to 35 years has been severely altered by fire exclusion and the effects of insects, disease, or fire may cause a loss of one or more defining ecosystem components (USDA FS 1999b). Condition Class 3 acreage in this mixed fire return interval category (35 to 100 years), comprise an additional 980,000 acres for a total of 2.3 million acres or 30 percent of the Late-Successional Reserve land base at a high risk of loss to wildfire. There are over 7.3 million acres of the entire Northwest Forest Plan area in Condition Class 3 in the stand-replacement and mixed-severity regimes. Most of these Late-Successional Reserve acres are found in the drier provinces of the eastside and California Cascades and the Oregon and California Klamath Physiographic Provinces and, to a lesser degree, in the California Coast Range and Oregon Western Cascades Physiographic Provinces. Wildfires historically burning in the 0 to 35-year fire return interval range burned predominantly in a low fire intensity condition that maintain conditions supporting low to moderate intensity surface fires, not stand-replacement fires.

## Environmental Consequences

Susceptibility to high intensity wildfire, as described by fire frequency and the condition class of the Northwest Forest Plan area, is the basis for the analysis of the alternatives. An estimate of annual acreage burned under historic natural fire regimes were derived using fire return interval data (USDA FS 1999b). For the 0 to 35-year fire return interval, an average fire return interval of 20 years was used for analysis purposes. Mixed conifer stand types in California, and ponderosa pine across the Northwest Forest Plan area have low intensity fire return frequencies from 3 to 20 years. There are other mixed conifer and woodland types in the southwest Oregon province that are in the 5 to 30-year range (Agee 1993). An 80-year average was used for analysis purposes in

the 35 to 100-year fire return interval. The 200+ fire return interval used a 250-year average. Using these factors, an estimated 476,357 burned annually. Considering the stochastic nature of fire occurrences, this may be better expressed as 4,763,570 acres burning per decade, historically. This figure is useful for comparing numbers of acres of wildfire, wildland fire use for resource objectives, prescribed fire, and other management activities with historical fire patterns.

From 1986 to 1996, approximately 1,137,715 acres burned by wildfire per decade in the Northwest Forest Plan area. Almost 91 percent of this total occurred in the dry provinces of the Eastern Cascades and the Klamath Provinces of Oregon and California. Wildfire will continue to threaten the habitats of Survey and Manage species. There is not sufficient data since the adoption of the Northwest Forest Plan to analyze burned acre trends. However, the fire regime information indicates that a high percentage of the Northwest Forest Plan area is at risk. The Wenatchee, Klamath, Shasta-Trinity, and Six Rivers National Forest fire events indicate that the number of acres of habitat severely impacted by wildfire may increase. If initial attack capability continues to decline at the ground level, in the absence of an aggressive fuels management program, there likely will be more acres burning at higher fire intensities.

### **Wildland Fire Use**

Wildland Fire Use, formerly known as Prescribed Natural Fire, is the term used for managing natural fire ignitions to meet resource objective purposes. Survey and Manage requirements have the potential to severely limit Wildland Fire Use. Pre-disturbance surveys are not required in Alternatives 1, 2, and 3 for wildland fire use in designated Wilderness.

Exceptions to the pre-disturbance survey requirement may be proposed (subject to Regional Ecosystem Office (REO) review) for other Wildland Fire Use in backcountry, Wilderness Study Areas, roaded natural, and similar areas where the objective of such fires is similar to Wilderness. Exceptions to the pre-disturbance survey requirement may also be proposed for Wildland Fire Use in Late-Successional Reserves, if the Late-Successional Reserve Assessment addresses the potential presence and likely affect on Survey and Manage species, and REO review of that aspect of the Late-Successional Reserve Assessment concludes such fire(s) will not prevent achievement of the persistence objectives of the selected alternative. It is reasonable to assume that 725,000 acres per decade, or 72,500 acres annually, could be burned in designated Wilderness or similarly managed areas with the use of these exceptions. These potential exceptions are not included in the No-Action Alternative, and could greatly increase cost of prescribed fire in such areas or reduce acres treated.

### **Prescribed Fire and Fuels Management**

There are currently 7.3 million acres in all land allocations, including over 2.3 million acres in Late-Successional Reserves, within the Northwest Forest Plan area that are predisposed to fire events well outside the range of natural intensity. The annual number of acres burned historically by wildfire is approximately 476,000 acres. This historical level is used as a substitute for acres of fuel appropriately treated by fire or other means on an annual basis. Average annual wildfire acres of 113,500, and projected Wildland Fire Use of 72,500 (as described above) were subtracted, leaving 290,000 acres potentially available for hazard reduction activities, requiring Survey and Manage pre-disturbance surveys. However, budget, personnel, air quality, and other constraints reduce consideration to approximately 190,000 acres annually. From this, the current program of 80,000 acres per year, plus fuels treated as part of timber sales, is derived. This current level is assumed for the No-Action Alternative, and changes displayed for the action alternatives are attributable to the Survey and Manage Standards and Guidelines.

Fuels are treated on a portion of the 190,000 acres through the timber sale program, which varies by alternative. Data used in the Costs of Management section of this chapter indicates approximately 87,000 acres would be harvested (including all harvests in all seral stages) to meet the declared PSQ.

Prescribed fire acres available in the No-Action Alternative are projected to be 78,500 acres, using the following calculations. For this alternative, 140,400 acres are potentially available for fuel treatment after 49,600 acres treated for timber sales are subtracted from 190,000. Pre-disturbance surveys are planned for 10 percent more acres, or 154,440 acres, because acres are eliminated during the project planning process for a variety of reasons other than Survey and Manage. The actual acres available for prescribed fire will be reduced by the presence of Survey and Manage species sites, and is estimated below. Analysis in the Timber Harvest section indicates 42 percent of the late-successional acreage will be managed as known sites in the No-Action Alternative. With approximately 35 percent of the Northwest Forest Plan area in late-successional stands, this translates to nearly 14.7 percent of the total landscape in known sites. Experience with designing prescribed fires to protect known sites indicates that it is necessary to prohibit burning on three times the number of acres than are actually in the sites; thus, 44 percent of the 140,400 acres are not available for treatment.

Pre-disturbance survey costs for the No-Action Alternative are projected to be \$439 per acre (long term, see Costs of Management section in this chapter). With surveys covering 154,440 acres (to treat 78,500 acres) total pre-disturbance survey cost are \$67,800,000 or \$862 per acre treated.

Prescribed fire acres available in Alternative 1 are projected to be 103,600 acres. For this alternative, 109,100 acres are potentially available for fuel treatment after 80,900 acres treated for timber sales are subtracted from 190,000. Pre-disturbance surveys are planned for 10 percent more acres, or a total of 120,000 acres. The actual acres available for prescribed fire will be reduced by the presence of Survey and Manage species sites. Analysis in the Timber Harvest section indicates 7 percent of the late-successional acreage would end up in known sites. With approximately 35 percent of the Northwest Forest Plan area in late-successional stands, this translates to 2.5 percent of the total landscape being in known sites. Although some of these sites may not prohibit the use of prescribed fire (see Management Recommendations Standards and Guidelines in Chapter 2), burning conditions around other sites could necessitate keeping prescribed fire entirely off the slope where known sites occur. On average, known sites are expected to prohibit burning on two times more acres than are in known sites; thus, a total of 5 percent of the 109,100 acres is not available for treatment.

Pre-disturbance survey costs for Alternative 1 are projected to be \$64 per acre. With surveys covering 120,000 acres (to treat 103,600 acres) total pre-disturbance cost are \$7,681,000 or \$74 per acre treated.

Prescribed fire acres available in Alternative 2 are projected to be 103,400 acres. For this alternative, 107,300 acres are potentially available for fuel treatment after 82,700 acres treated with timber sales are subtracted from 190,000. Pre-disturbance surveys are planned for 10 percent more acres, or a total of 118,000 acres. The actual acres available for prescribed fire will be reduced by the presence of Survey and Manage species sites. Analysis in the Timber Harvest section indicates 5 percent of the late-successional acreage would end up in known sites. With approximately 35 percent of the Northwest Forest Plan area in late-successional stands, this translates to 1.75 percent of the total landscape being in known sites. Although some of these sites may not prohibit the use of prescribed fire (see Management Recommendations Standards and Guidelines in Chapter 2), burning conditions around other sites could necessitate keeping prescribed fire entirely off the slope where known sites occur. On average, known sites are expected to prohibit burning on two times more acres than are in known sites; thus, a total of 3.5 percent of the 107,300 acres is not available for treatment.

Pre-disturbance survey costs for Alternative 2 are projected to be \$48 per acre. With surveys covering 118,000 acres (to treat 103,400 acres) total pre-disturbance survey costs are \$5,664,000 or \$55 per acre treated.

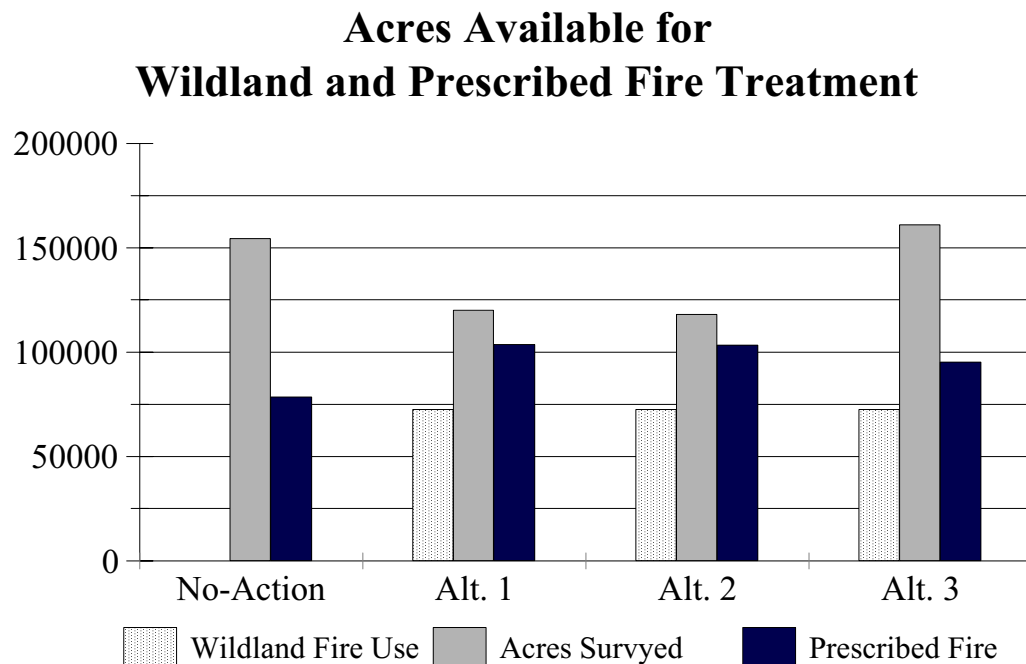
Prescribed fire acres available in Alternative 3 are projected to be 95,200. For this alternative, 146,500 acres are potentially available for fuel treatment after 43,500 acres treated with timber sales are subtracted from 190,000. Pre-disturbance surveys are planned for 10 percent more acres,

or a total of 161,000 acres. The actual acres available for prescribed fire will be reduced by the presence of Survey and Manage species sites. Analysis in the Timber Harvest section indicates 50 percent of the late-successional acreage would end up in known sites. With approximately 35 percent of the Northwest Forest Plan area in late-successional stands, this translates to 17.5 percent of the total landscape being in known sites. Although some of these sites may not prohibit the use of prescribed fire (see Management Recommendations Standards and Guidelines in Chapter 2), burning conditions around other known sites could necessitate keeping prescribed fire entirely off the slope where known sites occur. On average, known sites are expected to prohibit burning on two times more acres than are in known sites; thus, a total of 35 percent of the 146,500 acres is not available for treatment.

Pre-disturbance survey costs for Alternative 3 are projected to be \$171 per acre. With surveys covering 161,000 acres (to treat 95,200 acres) total pre-disturbance survey costs are \$27,557,000 or \$289 per acre treated.

## Comparison of the Alternatives

The relative number of acres available for fuels treatments (not including timber harvest) on an annual basis varies by alternatives. Acres assumed to be treatable for wildland fire use is 72,500 acres in the action alternatives, with no acres available in the No-Action Alternative. In the No-Action Alternative, 154,440 acres would be surveyed to potentially treat 78,500 acres for fuel hazard reduction. In Alternative 1, 120,000 acres would be surveyed to potentially treat 103,600 acres; in Alternative 2, 118,000 acres would be surveyed to potentially treat 103,400 acres; and in Alternative 3, 161,000 acres would be surveyed to potentially treat 95,200 acres. This information is shown in Figure 3&4-3. At these levels, the total of all treatments will cover 7.3 million acres in 20 years, but falls about 100,000 acres per year short of historic wildfire acreage.



**Figure 3&4-3.** Relative number of acres available for hazard fuels treatment on an annual basis.

The cost of conducting these pre-disturbance surveys for Survey and Manage species is estimated to be \$862 per acre treated in the No-Action Alternative, \$74 per acre treated in Alternative 1, \$55 per acre treated in Alternative 2, and \$289 per acre treated in Alternative 3. Associated with the costs of doing the pre-disturbance surveys is the cost of the actual fuel treatment activity, planning, and monitoring which varies from \$150 to \$300 per acre. The No-Action Alternative and Alternative 3 could likely be considered economically unfeasible for the prescribed fire program, when the cost of pre-disturbance surveys are added to the cost of program implementation. While Alternatives 1 and 2 substantially increase cost, particularly on a percent basis, the prescribed fire program would be economically feasible.

The comparison of alternatives described above is based on an assumption that the emphasis on prescribed fire will not change. Recent events, including apparent increases in wildfire acreage and intensity, have led to a higher emphasis on the treatment of natural fuels than in the past. Treatment levels in the next few years are expected to be double the levels shown here, and the full 290,000 acres available for analysis (described above) is considered. As this happens, the total costs displayed above will increase proportionately, but the relative differences between the alternatives will remain approximately the same.

## Bryophytes

### General Discussion

Mosses, liverworts, and hornworts (collectively referred to as bryophytes) are small, green, nonvascular, spore-bearing plants that have evolved into a wide array of species well adapted to nearly every habitat on earth. About 170 species of liverworts and 450 species of mosses occur within the Northwest Forest Plan area. About 20 percent of these species are endemic to western North America or to the Pacific Northwest (Lawton 1971).

Old-growth forests may be essential to the continued existence of some bryophyte species. Some species do not become established in forests before these stands attain 100 years of age, and they are best developed in stands 400 years or older. Bryophytes are important components in the forest canopy and understory habitats of late-successional and old-growth forests, and contribute to the species diversity, primary productivity, and biomass of these stands.

Bryophytes perform many ecological functions within late-successional and old-growth forests. Bryophytes provide food and habitat for a host of invertebrates (Russell 1979, Gerson 1982, Varga 1992) and vertebrates. Marbled murrelets nest in moss mats in old-growth trees. Flying squirrels, birds, and mammals commonly use mosses to build their nests. Bryophytes are a perennial source of organic material and function as efficient filters for trapping sediments. They also intercept, absorb, and buffer nutrients and water in the canopy and understory (Brown and Bates 1990). They play an important role in the dynamics of understory vegetation, as well as soil structure, soil stability, and the interception and retention of water. Bryophytes are also a major component of the forest stream ecosystem, providing year-round habitat for a wide array of algal species, aquatic invertebrates, and amphibians.

The Survey and Manage Standards and Guidelines were originally applied to 23 bryophyte species, including both mosses and liverworts. Eight of these bryophyte species were included because they did not pass the screens of the additional species analysis in the Northwest Forest Plan Final SEIS, and it was thought that additional mitigation was needed to provide for species persistence. Fifteen species that were not rated during the FEMAT viability panels because of insufficient information, were included in the Survey and Manage Standards and Guidelines requiring management of known sites while acquiring information necessary to address concerns for species persistence. The Protection Buffer Standards and Guidelines were applied to eight bryophytes. Three of these species were also listed under the Survey and Manage Standards and Guidelines: *Ptilidium californicum*, *Brotherella roellii*, and *Tetraphis geniculata*. In the

Northwest Forest Plan ROD, there are currently 27 bryophytes under the Survey and Manage and/or Protection Buffer Standards and Guidelines. *Buxbaumia piperi* was originally included in the Protection Buffer Standards and Guidelines and was removed under a joint memorandum issued by the Forest Service and BLM in 1996.

Since 1994, new information has been acquired on the occurrence and distribution of the bryophyte species assigned to the Survey and Manage and/or Protection Buffer Standards and Guidelines. Information has been acquired from field surveys, herbaria, literature, field units, and taxonomic experts. This information was evaluated when determining the appropriate level of mitigation for the bryophyte species covered by these standards and guidelines (Appendix F). Due to the limited information available about these species within the Northwest Forest Plan area, the historic distributions of these species is unknown. Therefore, the geographic distribution and biological (reference) distribution for these species are inferred from the available information on the current distribution and habitat associations within the species range.

## Summary of Effects

Because of the number of bryophyte species discussed and the length of this section, a brief summary is provided here, prior to the detailed discussion.

Eleven species would be removed from Survey and Manage and Protection Buffer Standards and Guidelines under the action alternatives, either in all (10 species) or portions of their range (1 species), because they no longer meet the basic criteria to be included under the Survey and Manage Standards and Guidelines.

Under all alternatives, for the 11 bryophytes that would be removed from the Survey and Manage Standards and Guidelines across all or portions of their ranges, 5 would have sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distribution, 1 would have sufficient habitat (including known sites) to allow the species to stabilize in a pattern different from its reference distribution, 4 would have inadequate habitat (including known sites) for species maintenance, and for 1 species there is insufficient information to determine stability and distribution.

Four species would be removed from the Survey and Manage Standards and Guidelines under the action alternatives because they do not meet the basic criterion of being closely associated with late-successional or old-growth forest. These four species (*Bartramiopsis lescurii*, *Herbertus sakuraii*, *Plagiochila semidecurrens*, and *Radula brunnea*) would be at risk for not maintaining a stable population primarily because all except one known site for these four species are located on nonfederal lands and are not closely associated with late-successional or old-growth forest. However, these four species are being considered for the Agencies' special status species programs.

For the 17 species remaining under the Survey and Manage Standards and Guidelines (16 throughout their ranges and 1 in a portion of its range), all alternatives have similar management actions that vary by alternative: (1) manage known sites; (2) pre-disturbance surveys; and, (3) strategic surveys or extensive and general regional surveys. The provision for conducting strategic surveys under the action alternatives and extensive or general regional surveys under the No-Action Alternative would increase the efficiency and effectiveness of species management in the future, by prioritizing and targeting surveys to address specific questions relative to management necessary for a species.

The three action alternatives have similar provisions for adaptive management to allow the Agencies to respond to changing information and to provide appropriate management for species. Adaptive management would result in more effective management by assigning the species to the category that provides the appropriate level of mitigation needed for long-term species stability.

Compared to the No-Action Alternative, species receive different management under the action alternatives as a result of the application of new information and the slightly different emphasis of the alternatives. Under Alternatives 1 and 2, pre-disturbance surveys would be removed for seven bryophytes and strategic surveys would be added for five bryophytes. Under Alternative 3, equivalent-effort, pre-disturbance surveys would be added for seven bryophytes and removed for one bryophyte; strategic surveys are added for five bryophytes.

Most bryophytes have an equal or greater likelihood of a stable population under the action alternatives when compared to the No-Action Alternative.

The uncertainty varies by alternative for three of the species (*Diplophyllum albicans*, *Schistostega pennata*, and *Buxbaumia viridis*) that would remain under Survey and Manage. While there is moderate level of uncertainty (due to lack of knowledge and only three recent federal sites), the No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) for *Diplophyllum albicans* to stabilize in a pattern similar to its reference distribution. This same conclusion applies to Alternative 2, however, with a high degree of uncertainty because only sites known as of September 30, 1999, would be managed. For *Buxbaumia viridis*, the No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow *Buxbaumia viridis* to stabilize in a pattern similar to its reference distribution. This same conclusion applies to Alternative 2, however, with a moderate level of uncertainty because only sites known as of September 30, 1999, would be managed. For *Schistostega pennata*, all alternatives would provide sufficient habitat (including known sites) for the species to stabilize in a pattern similar to its reference distribution with a high level of uncertainty in the No-Action Alternative and with a moderate level of uncertainty in the action alternatives.

Fourteen other bryophyte species would remain under Survey and Manage. For four of these species, while there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distributions. For the remaining 10 bryophyte species, there is insufficient information to determine how any alternative would affect distribution and stability. The concerns for stability are because of the low number of sites.

## **Bryophytes Proposed for Removal from the Survey and Manage Standards and Guidelines Under the Action Alternatives**

*Bartramiopsis lescurii*, *Herbertus sakuraii*, *Plagiochila semidecurrens*, and *Radula brunnea*

### **Background and Affected Environment**

*Bartramiopsis lescurii* is a northern species that reaches the southern extent of its range in northern Washington. The only known site for this species in the Northwest Forest Plan area is on the Mt. Baker-Snoqualmie National Forest, where it occurs in a non-forest community on talus. This species is thought to be rare in Washington (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b).

*Herbertus sakuraii*, *Plagiochila semidecurrens*, and *Radula brunnea* reach the southern extent of their range for North America in northwestern Oregon. These species are known only from one site in the Northwest Forest Plan area, on Saddle Mountain in the Oregon Coast Range, which is nonfederal land (Christy and Wagner 1996). The habitat at the known site is a non-forest community on a north-facing basalt cliff near the summit (USDA, USDI 1996; USDA, USDI 1998f; and USDA, USDI Species Review Panel 1999b). These species appear to be rare in the Pacific Northwest.

All four of these species have similar distribution patterns. Current information suggests they are extremely limited geographically, their distribution is limited to a small portion within their ranges, and they occur in isolated sites where they do exist.

## Environmental Consequences and Comparison of Alternatives

These four species are proposed for removal from the Survey and Manage Standards and Guidelines under the three action alternatives because they do not meet the criterion for being closely associated with late-successional or old-growth forests. However, these species remain at risk because they are thought to be rare, there is only one known site for each species in the Northwest Forest Plan area, and only one species has a known site on federally managed land. These species are being evaluated for inclusion in the Agencies' special status species programs.

*Bartramiopsis lescurii*, *Herbertus sakuraii*, *Plagiochila semidecurrens*, and *Radula brunnea* are in Categories 1 and 3 under the No-Action Alternative, where all current and future known sites would be managed, and extensive surveys would be required for these species. However, the only site under federal management for these four species is a single site for *Bartramiopsis lescurii* on the Mt. Baker-Snoqualmie National Forest. The other known sites are on nonfederal land outside of the jurisdiction of the Northwest Forest Plan. Because of the very limited distribution, the low number of known sites, and lack of federal sites for these species, all alternatives would provide inadequate habitat (including known sites) to maintain these species.

### *Scouleria marginata* and *Ulotia megalospora*

#### Background and Affected Environment

*Scouleria marginata* is endemic to the Pacific Northwest. It has a wide distribution within this area and has been reported from Washington south into California. This species is not closely associated with late-successional or old-growth forests; it occurs in or near streams in both exposed or shaded conditions (Christy and Wagner 1996), and does not require the canopy of a late-successional forest. There are few reported sites for this species in the Northwest Forest Plan area, although there has been limited survey effort. It is known from 14 total sites, 4 are recent federal sites (Table F-2 and USDA, USDI Species Review Panel 1999b). Under the FEMAT process, *Scouleria marginata* was rated as having a high likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands. *Scouleria marginata* was originally included in Survey and Manage Component 4 because of concerns that cumulative effects on nonfederal land may raise concerns about the species viability on federally managed lands (Appendix J2 in USDA, USDI 1994a). Current information suggests that *Scouleria marginata* is geographically widespread, its distribution is limited throughout its range, and it occurs in isolated site clusters.

Current information suggests *Ulotia megalospora* is a common species with a widespread but spotty distribution within the Northwest Forest Plan area, and there is the potential for limited connectivity among sites and clusters. This species does not meet the criterion of being closely associated with late-successional or old-growth forests because it occurs on a wide variety of substrates in a broad range of habitats and stand ages, from low elevation to montane areas (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b). *Ulotia megalospora* was one of two species in the Canopy Twigs-Exterior group in the FEMAT analysis, and was rated as having a high likelihood of having habitat of sufficient quality, distribution, and abundance to support stable, well-distributed populations across federally managed lands (USDA et al. 1993). *Ulotia megalospora* was included as a Protection Buffer species in the Northwest Forest Plan ROD, where it was stated that it is locally abundant in northern California and southwestern Oregon, but is generally scarce throughout its range, as well as being poorly known ecologically (USDA, USDI 1994b). There were 37 sites reported prior to 1993 (Table F-2). Information acquired since 1994 indicates this species is stable throughout its range in the Northwest Forest Plan area, with over 1,300 new sites on federally managed land recorded since 1993 (USDA, USDI Species Review Panel 1999b and Table F-2). In addition, habitat data indicate it is not closely associated with late-successional or old-growth forests. This species is probably more widespread and common than the data represents. Known site reports are steadily increasing as field personnel complete surveys.



## Environmental Consequences and Comparison of Alternatives

The No-Action Alternative requires management of known sites and pre-disturbance surveys for *Ulotia megalospora*, and general regional surveys for *Scouleria marginata*. *Scouleria marginata* and *Ulotia megalospora* would receive greater protection under the No-Action Alternative compared to the action alternatives due to the requirement to manage known sites and conduct pre-disturbance surveys for *Ulotia megalospora*, and to conduct general regional surveys for *Scouleria marginata*. However, the three action alternatives remove *Scouleria marginata* from the Survey and Manage Standards and Guidelines and *Ulotia megalospora* from the Protection Buffer Standards and Guidelines because they do not meet the criterion for being closely associated with late-successional or old-growth forests. In addition, the provisions of the Northwest Forest Plan provide a reasonable assurance of maintaining stable, well-distributed populations of *Ulotia megalospora* across its range within the Northwest Forest Plan area.

*Ulotia megalospora* is a common and widespread species and is provided for by the Northwest Forest Plan without the Protection Buffer Standards and Guidelines (USDA, USDI Species Review Panel 1999b). *Ulotia megalospora* occurs in a broad range of habitat conditions and stand ages. The reserve land allocations and other standards and guidelines such as green tree retention will provide habitat for *Ulotia megalospora* throughout its range in the Northwest Forest Plan area. All alternatives provide sufficient habitat (including known sites) to allow *Ulotia megalospora* to stabilize in a pattern similar to its reference distribution across its range within the Northwest Forest Plan area.

*Scouleria marginata* is an aquatic or riparian species and the Aquatic Conservation Strategy should provide protection for populations throughout the Northwest Forest Plan area. While there is a moderate level of uncertainty due to few known sites and lack of knowledge, all alternatives would provide sufficient habitat (including known sites) to allow *Scouleria marginata* to stabilize in a pattern similar to its reference distribution across its range within the Northwest Forest Plan area. The No-Action Alternative does not manage known sites for this species, but additional populations may be located through general regional surveys. This species is being evaluated for inclusion in the Agencies' special status species programs.

### *Pleuroziopsis ruthenica*

#### Background and Affected Environment

The global distribution of *Pleuroziopsis ruthenica* includes Japan, the Russian Far East, Alaska, and British Columbia. In Alaska and British Columbia, *Pleuroziopsis ruthenica* occurs along creek banks and hummocks, and in low-elevation shrub thickets (USDA, USDI 1998f). Reports of its abundance vary from very rare in northern British Columbia (Schofield 1976), rare throughout its Pacific range (Schofield 1990), and common in the north (Pojar and MacKinnon 1994 and USDA, USDI 1998f).

*Pleuroziopsis ruthenica* is reported from only one historical collection in the Northwest Forest Plan area. The historical collection was made by N. L. Gardner in about 1898 "in marsh, Seattle" (USDA, USDI 1998f). This collection is subject to question because of potential mislabeling of the specimen, and because the habitat likely no longer exists (USDA, USDI Species Review Panel 1999b and Harpel 1999 pers. comm.), as well as being far south of its present range. Christy and Wagner (1996) note skepticism from some bryologists that this species was actually collected in Puget Sound, although state it may be a "real vestige of a vanished landscape."

Despite extensive bryological collection in Washington State over the last century, no additional collections of this species have been made. The geographic and biological distribution of *Pleuroziopsis ruthenica* within the Northwest Forest Plan area remains unknown at this time. Because there are no documented sites of this species that can be verified, this species is currently assumed to not occur in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b).

## Environmental Consequences and Comparison of Alternatives

*Pleuroziopsis ruthenica* is in Categories 1 and 3 under the No-Action Alternative, where all current and future known sites would be managed, and extensive surveys would be required. Under the three action alternatives, this species would be removed from the Survey and Manage Standards and Guidelines because it does not meet the criterion of occurring in the Northwest Forest Plan area. Because *Pleuroziopsis ruthenica* is no longer considered to be extant within the Northwest Forest Plan area, no adverse effects to this species would be expected from land management activities prescribed under the Northwest Forest Plan.

### *Antitrichia curtipendula* and *Douinia ovata*

## Background and Affected Environment

*Antitrichia curtipendula* is a widespread and common species throughout the Northwest Forest Plan area (Christy and Wagner 1996). The number of known sites for this species has increased from 204 to 491 since 1993, with 206 recent federal sites, despite limited survey efforts. This species is common, and generally under-collected; there are many populations on the landscape that are not represented in the Interagency Species Management System (ISMS) database, or in herbaria collections. *Antitrichia curtipendula* occurs in a broad range of habitats from low elevation to mid-montane forests, and may be abundant where it occurs (USDA, USDI Species Review Panel 1999b). Current information suggests that *Antitrichia curtipendula* is widespread geographically, its distribution is spotty within its range, and there is the potential for limited connectivity among sites and clusters.

*Douinia ovata* is a widespread species at low elevations in habitats with cool, moist sites. *Douinia ovata* is not restricted to forest habitats. It may occur in stands of various ages as well as on rock or soil in cool, moist sites (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b). The number of known sites for this species has increased from 23 to 55 since 1993, with 23 recent federal sites, despite limited survey efforts (USDA, USDI Species Review Panel 1999b). Current information suggests that *Douinia ovata* is widespread geographically, its distribution is spotty within its range, and there is the potential for limited connectivity among sites and/or clusters.

*Antitrichia curtipendula* and *Douinia ovata* were rated as the Canopy Interior group in the FEMAT analysis. They were rated a moderately high likelihood of having “habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize well distributed across federal land” and a low likelihood that the populations would “stabilize, but with significant gaps in the historic species distribution on federal land” (USDA et al. 1993). Both species were included in Survey and Manage Category 4 because of concerns that cumulative effects on nonfederal land (habitat loss and potential effects of declining air quality) may raise concerns about the species viability on federally managed lands (Appendix J2 in USDA, USDI 1994a).

## Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, general regional surveys would be required for both species. These regional surveys would provide additional information on the distribution of these species. However, it is already documented that these species have well-distributed populations within the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b). The original concerns for these species were based on cumulative effects on nonfederal land (Appendix J2 in USDA, USDI 1994a). The mitigation under the No-Action Alternative would not address these concerns, which are beyond the scope of the Northwest Forest Plan.

Under the three action alternatives, *Antitrichia curtipendula* and *Douinia ovata* would be removed from the Survey and Manage Standards and Guidelines. The reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide habitat well distributed throughout the species' ranges. Taxa experts and the species review panel determined these species are

widespread and common (USDA, USDI Species Review Panel 1999b). While there is a moderate level of uncertainty (due to lack of knowledge) all alternatives would provide sufficient habitat (including known sites) to allow *Douinia ovata* to stabilize in a pattern similar to its reference distribution. For *Antitrichia curtipendula*, while there is a moderate level of uncertainty (primarily due to activities on nonfederal lands) all alternatives would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from its reference distribution.

### ***Plagiochila satoi***

#### **Background and Affected Environment**

Based on current information, *Plagiochila satoi* is now considered part of the *P. asplenoides* complex (USDA, USDI Species Review Panel 1999b and Harpel 1999 pers. comm.). *Plagiochila asplenoides* is a widespread and common species (USDA, USDI Species Review Panel 1999b). The FEMAT bryophyte panel placed the *Plagiochila asplenoides* complex in the Wet Shaded Humic Soil group, which was rated a very high likelihood of having “habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize well distributed across federal land” and a very low likelihood that the populations would “stabilize, but with significant gaps in the historic species distribution on federal land” (USDA et al. 1993). Current information suggests that *Plagiochila satoi* is widespread geographically, but its distribution is spotty within its range and it has the potential for limited connectivity among sites and/or clusters.

#### **Environmental Consequences and Comparison of Alternatives**

*Plagiochila satoi* is proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives. Taxonomic studies realigned *Plagiochila satoi* within another species complex (*Plagiochila asplenoides*), which is common and widespread within the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b). Under the No-Action Alternative, all known sites would be managed and extensive surveys would be required for *Plagiochila satoi*.

Alternatives 1, 2, and 3 would not adversely affect *Plagiochila asplenoides* because this species is widespread and common throughout the Northwest Forest Plan area. The reserve land allocations would provide the habitat necessary to maintain stable populations (USDA, USDI Species Review Panel 1999b). All alternatives would provide sufficient habitat (including known sites) for *Plagiochila asplenoides* to stabilize in a pattern similar to its reference distribution.

## **Bryophyte Proposed to Remain Under Survey and Manage Standards and Guidelines Under All Alternatives for Only a Portion of Its Range**

### ***Ptilidium californicum***

#### **Background and Affected Environment**

*Ptilidium californicum* has a North Pacific distribution, occurring along the west coast of North America from northern California to southeastern Alaska, and extending to northern Japan (Christy and Wagner 1996; and Schuster 1966). *Ptilidium californicum* is a common and widespread species in the Pacific Silver Fir and Mountain Hemlock vegetation zones of northwestern Washington (Mt. Baker-Snoqualmie National Forest Ecology Program data files) and the Pacific Silver Fir zone in Oregon (Christy and Wagner 1996). It is now known to be widespread in the southern Oregon Cascades based on numerous recent records (USDA, USDI Species Review Panel 2000b). There are over 361 recent federal sites for Oregon and Washington in the ISMS database (Table F-2), with many additional sites documented in northwestern Washington (Mt. Baker-Snoqualmie National Forest Ecology Program data files). Within Oregon

and Washington, current information suggests that *Ptilidium californicum* is geographically widespread and evenly distributed within suitable habitat within its range, with the potential for limited connectivity among sites and/or clusters.

*Ptilidium californicum* reaches the southern limit of its range in northern California. In this area, the species becomes restricted to mid-elevation, old-growth, true fir forests below 5,000 feet (Appendix J2 in USDA, USDI 1994a; USDA, USDI 1998f; and USDA, USDI Species Review Panel 1999b). There are about 30 recent federal sites in northern California on the Lassen, Shasta-Trinity, and Rogue River National Forests (USDA, USDI Species Review Panel 2000b). Within California, current information suggests that *Ptilidium californicum* has a very limited geographic distribution, and its distribution is limited to a small portion within its range where it occurs in isolated site clusters.

Previous analyses reported different concerns for persistence of *Ptilidium californicum* depending on the geographic area (Thomas et al. 1993; USDA et al. 1993; and Appendix J2 in USDA, USDI 1994a). The FEMAT bryophyte panel rated *Ptilidium californicum* in two different groups based on its geographic distribution. *Ptilidium californicum* in Oregon and Washington was included in the Tree Boles/Understory group and was rated a high likelihood of having “habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize well distributed across federal lands.” *Ptilidium californicum* in California was included in the Rare Species group and rated separately with a high likelihood of having “habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize well distributed across federal lands.” However, between the draft and final Northwest Forest Plan SEIS, the 180-year rotation was eliminated for California, elevating the concern for this rare species in California (Appendix J2 in USDA, USDI 1994a). *Ptilidium californicum* was added to the Survey and Manage Standards and Guidelines, but the geographic designation of California was inadvertently omitted from Table C-3 (USDA, USDI 1994b). In addition, *Ptilidium californicum* was included as a Protection Buffer species, but the geographic designation of California was also inadvertently omitted (Appendix 5-H in Thomas et al. 1993 and USDA, USDI 1994b, p. C-20). The viability concerns expressed for *Ptilidium californicum* by the taxonomic experts had been for the California populations only (Thomas et al. 1993; USDA et al. 1993; and Appendix J2 in USDA, USDI 1994a).

Pre-disturbance surveys are considered practical for *Ptilidium californicum*. It is a conspicuous and distinctive liverwort that can be readily located and identified in the field.

### **Environmental Consequences and Comparison of Alternatives**

Current information indicates that portions of the range of *Ptilidium californicum* warrant different management direction based on different levels of concern. Concerns for maintaining stable populations are highest for *Ptilidium californicum* in California, where the species reaches the southern extent of its range, has a limited distribution, and is rare. *Ptilidium californicum* would likely exist in stable populations in Oregon and Washington because, in this part of its range, the species is widespread and common within suitable habitat.

*Ptilidium californicum* would benefit from the requirement in the Northwest Forest Plan to retain old-growth fragments in watersheds where little remains. However, if the oldest stands are not selected for protection in landscape areas where little late-successional forest exists (USDA, USDI 1994b, p. C-44), the Survey and Manage Standards and Guidelines would become more important for this species.

Under the No-Action Alternative, *Ptilidium californicum* throughout its range is in Categories 1 and 2 and is a Protection Buffer species. Under these categories, all current and future known sites would be managed and pre-disturbance surveys would be required. The No-Action Alternative did not distinguish geographic differences in the concern for maintaining stable populations within this species' range. In areas where there is little concern, the Survey and Manage and Protection Buffer Standards and Guidelines are not necessary because the species is

well distributed and there is abundant suitable habitat that is occupied within reserve land allocations. For these reasons, in the three action alternatives, management for *Ptilidium californicum* has been divided into two geographic areas: (1) California and (2) Washington and Oregon.

As discussed below, under the action alternatives Washington and Oregon populations of *Ptilidium californicum* would be removed from management under the Survey and Manage and Protection Buffer Standards and Guidelines.

#### In California

California populations of *Ptilidium californicum* would be in Categories 1A, 2A, and 3A under the action alternatives. All current and future known sites would be managed and pre-disturbance and strategic surveys would be required.

While management of known sites would occur under all alternatives, there are some differences among the action alternatives. Alternative 3 requires a 250-meter buffer around each known site while Alternatives 1 and 2 state that the size of the area to be managed depends upon the habitat and requirements of the species. The prescribed area for management of known sites under Alternative 3 could provide larger habitat areas for recruitment and expansion of the population which could result in larger or more stable populations over time. However, if the species is thought to require interior microclimate, there would be little difference in site management under the action alternatives because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3.

All alternatives would require pre-disturbance surveys for *Ptilidium californicum* in California. These surveys would result in minimizing inadvertent loss of undiscovered sites of *Ptilidium californicum*. Strategic surveys would be required for *Ptilidium californicum* under all three action alternatives, but would not be required under the No-Action Alternative. Strategic surveys could provide the information necessary for managing the species, such as: (1) finding additional sites; (2) determining if known sites are still extant; (3) characterizing habitat at known sites; (4) improving distribution and population information; (5) providing information to determine the management needs of *Ptilidium californicum*; and, (6) narrowing the habitat where pre-disturbance surveys would be required. It would be difficult to gather such information under the No-Action Alternative, since pre-disturbance surveys are limited to project areas. Strategic surveys could provide the information necessary to determine the appropriate management to reduce concerns for *Ptilidium californicum*. While there is a moderate level of uncertainty due to the low number of sites, environmental stochasticity, and limited knowledge of its distribution, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

#### In Washington and Oregon

Under all actions alternatives, *Ptilidium californicum* in Washington and Oregon would be removed from the Survey and Manage Standards and Guidelines. Under the No-Action Alternative, *Ptilidium californicum* throughout its range is in Categories 1 and 2 and is also a Protection Buffer species. Under these categories, all current and future known sites would be managed, and pre-disturbance surveys would be required. This provides mitigation for *Ptilidium californicum* throughout this portion of its range where there are no concerns for persistence given its widespread distribution and abundance (Thomas et al. 1993; USDA et al. 1993; and Appendix J2 in USDA, USDI 1994a).

There would be no adverse effects to *Ptilidium californicum* due to its removal from the Survey and Manage and Protection Buffer Standards and Guidelines in Washington and Oregon under the three action alternatives. *Ptilidium californicum* in Washington and Oregon does not meet the

basic criteria for inclusion under the Survey and Manage Standards and Guidelines. This is because the populations are now stable and there is sufficient potential habitat within the reserve land allocations, and because the reserve system and other standards and guidelines provide a reasonable assurance of species persistence. All alternatives would provide sufficient habitat (including known sites) to allow *Ptilidium californicum* to stabilize in a pattern similar to its reference distribution.

## **Bryophytes Proposed to Remain Under Survey and Manage Standards and Guidelines Under All Alternatives**

### ***Brotherella roellii***

#### **Background and Affected Environment**

*Brotherella roellii* is known only from five historical collections within the area of the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b and 2000b; and USDA, USDI 1999d). It is unknown if *Brotherella roellii* is still extant at these sites. *Brotherella roellii* is endemic to the Pacific Northwest, known from southern British Columbia and historically from Washington (Christy and Wagner 1996 and USDA, USDI 1999d). The geographic and biological distribution of *Brotherella roellii* within the Northwest Forest Plan area remains unknown at this time.

*Brotherella roellii* was included as a Protection Buffer species because it was thought to be rare and endemic to northern Washington (Appendix 5-H in Thomas et al. 1993 and USDA, USDI 1994b, p. C-27). For these same reasons, it was also included under the Survey and Manage Standards and Guidelines.

*Brotherella roellii* may not meet the criterion for close association with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and USDA, USDI 1999d). Christy and Wagner (1996) note it occurs at low elevation on slopes, stream terraces, and swampy floodplains; red alder and bigleaf maple are the preferred hardwood habitat. Recent habitat data from British Columbia populations indicate this species occurs in second-growth mixed conifer/deciduous forests (USDA, USDI Species Review Panel 1999b and 2000b; and USDA, USDI 1999d). Little is known about *Brotherella roellii* in the Northwest Forest Plan area.

Pre-disturbance surveys are considered not practical for this species (USDA, USDI Species Review Panel 1999b). *Brotherella roellii* is thought to be rare so destructive sampling is a concern (USDA, USDI Species Review Panel 1999b). Field detection of *Brotherella roellii* is problematic; it may be difficult to distinguish from a common species (*Hypnum circinale*) and these two species may grow intermixed and occur in the same habitat (Christy and Wagner 1996). In addition, microscopic examination is required for species identification (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b).

#### **Environmental Consequences and Comparison of Alternatives**

In the No-Action Alternative, *Brotherella roellii* is a Protection Buffer species and in Survey and Manage Categories 1 and 3. Under Categories 1 and 3, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be selected for management. In addition, as a Protection Buffer species, pre-disturbance surveys would be required before habitat-disturbing activities.

Because of uncertainties with this species status, *Brotherella roellii* is in Category 1E of Alternative 1 and Category 2C of Alternative 2. Under these categories, strategic surveys would be conducted.

In Alternative 3, *Brotherella roellii* is in Category 3A. Under this category, all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and

minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Strategic surveys would be conducted under all three action alternatives to determine if *Brotherella roellii* meets the criteria for close association with late-successional or old-growth forests, and if the species is still extant within the Northwest Forest Plan area. Under the three action alternatives, all current and future known sites would be managed until strategic surveys can determine if the species meets the basic criteria for inclusion under the Survey and Manage Standards and Guidelines.

Management of known sites for *Brotherella roellii* would be required under all alternatives, and would be the same under the No-Action Alternative and Alternatives 1 and 2 (i.e., management would be to maintain species at the site). The prescribed area for management of known sites under Alternative 3, a 250-meter buffer, could provide larger habitat areas for recruitment and expansion of the population which could result in larger or more stable populations over time. However, if the species is thought to require interior microclimate, there would be little difference in site management under all alternatives because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3 (250-meter buffer).

All five sites of *Brotherella roellii* in the Northwest Forest Plan area were reported in the early 1900s, and to date, none of these sites have been relocated. Since it is not known if *Brotherella roellii* is still extant at these sites nor is there precise location information available to be able to relocate the sites, management of currently known sites alone would not increase the likelihood that *Brotherella roellii* would maintain stable populations in the Northwest Forest Plan area, regardless of management applied to sites.

Surveys prior to habitat-disturbing activities would be required under the No-Action Alternative and Alternative 3. There may be additional known sites discovered because of these pre-disturbance surveys. There may be inadvertent loss of sites under Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted. This could result in the loss of sites that may be important to maintaining stable, populations of *Brotherella roellii* in the Northwest Forest Plan area. However, because this species is thought to be rare and may be easily confused with a common species (*Hypnum circinale*), only a few new sites would likely be found with pre-disturbance surveys. Given the uncertainty about whether this species is extant in the Northwest Forest Plan area, the impact of the potential loss of undiscovered sites is unknown.

Strategic surveys would be required under all action alternatives and extensive surveys would be required under the No-Action Alternative. These surveys could focus on likely sites where the species may occur, and address questions necessary for the management of *Brotherella roellii*, such as whether *Brotherella roellii* is still extant in the Northwest Forest Plan area, whether the species is closely associated with late-successional or old-growth forests, and what management is necessary to maintain stable populations of *Brotherella roellii* in the Northwest Forest Plan area. In addition, any site found with these surveys would be managed to maintain the species at the site. Strategic surveys could provide the information necessary to determine the appropriate management to reduce concerns for *Brotherella roellii*.

There is a lot of uncertainty regarding the status of *Brotherella roellii* in the Northwest Forest Plan area. Because this species has not been observed since the early 1900's, it is uncertain whether it is still extant in the Northwest Forest Plan area. Because so little is known about *Brotherella roellii*, there is insufficient information to determine how any alternative would affect the distribution and stability of this species.

***Diplophyllum plicatum*, *Kurzia makinoana*, *Marsupella emarginata* var. *aquatica*, *Tritomaria exsectiformis*, and *Rhizomnium nudum***

**Background and Affected Environment**

*Diplophyllum plicatum* has a North Pacific distribution from northeastern Asia around coastal Alaska and British Columbia south to Oregon (Christy and Wagner 1996). There are about 47 known sites in the Northwest Forest Plan area, with 24 sites documented on federally managed land since 1993 (USDA, USDI Species Review Panel 2000b and Table F-2). However, all of these collections since 1993 are from Coos Bay BLM (USDA, USDI Species Review Panel 2000b). Most of the collections prior to 1993 are from the Olympic Peninsula and northern Cascades of Washington (USDA, USDI Species Review Panel 1999b). It is not known if the species still occurs at these northern sites. Little is known about the habitat and ecological requirements of *Diplophyllum plicatum* (Christy and Wagner 1996). The FEMAT bryophyte panel included *Diplophyllum plicatum* in the Rare Species group and rated it as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands (USDA et al. 1993). *Diplophyllum plicatum* is described as rare with a spotty distribution (Appendix J2 in USDA, USDI 1994b). It was also noted that mitigation may not be effective because of the species rarity (Appendix J2 in USDA, USDI 1994b). Current information suggests that *Diplophyllum plicatum* has a moderate geographic distribution, its distribution is limited within its range, and it occurs in isolated site clusters where it does exist.

*Kurzia makinoana* is an extremely small liverwort that is thought to be rare in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b and Christy and Wagner 1996). Little is known about its abundance, distribution, and ecology (Appendix J2 in USDA, USDI 1994b and USDA, USDI Species Review Panel 1999b). It has a North Pacific distribution and occurs from Asia to California. *Kurzia makinoana* is reported from few sites in Washington, one recent site in Oregon (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b, 2000b), and one site in northern California. It is reported from old-growth forests in Washington, from a bog in Oregon, and from a decayed stump in California (Appendix J2 in USDA, USDI 1994b and Harpel 1999 pers. comm.). However, there is current taxonomic debate surrounding this species and closely related species within the genus *Kurzia* (Harpel 1999 pers. comm.). Until the identity of the collections for the Northwest Forest Plan are verified to determine their identification, there is uncertainty regarding the number of sites and habitats where this species occurs in the Northwest Forest Plan area. Due to the taxonomic confusion regarding *Kurzia makinoana*, there is a high level of uncertainty regarding its distribution pattern. Current information suggests that it has a limited geographic distribution, its distribution is limited to a small portion within its range, and it occurs in isolated sites where it does exist.

The FEMAT bryophyte panel rated *Kurzia makinoana* as having a high likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands, and was rated with a low likelihood of having “*habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution on federal land*” being restricted to refugia or extirpation (USDA et al. 1993). However, the low number of sites for this species elevate the concern for maintaining populations of *Kurzia makinoana* in the Northwest Forest Plan area compared to the conclusion of the FEMAT analysis.

*Marsupella emarginata* var. *aquatica* is an aquatic species that grows attached to rocks in streams. It is only known from one site within the Northwest Forest Plan area (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and Christy and Wagner 1996). For the FEMAT analysis, it was included in the Rare Species group, and was rated as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands, and a high likelihood of being confined to refugia (USDA et al. 1993). There is only one recent site reported on federally managed land, near the previously known location for this species (USDA, USDI Species Review Panel 1999b). Taxonomic experts



do not concur on the recognition of the variety *aquatica* (Step 2 panel notes 1999). Until this issue is resolved, it is difficult to determine the taxon's distribution and rarity within the Northwest Forest Plan area. At this time, the geographic and biological distribution of this species remains unknown.

*Tritomaria exsectiformis* is known from 10 sites in the Northwest Forest Plan area. It occurs on the east side of the Cascades, near perennial seeps and springs. There were three sites known as of 1993; seven sites have been discovered on the Deschutes National Forest since that time (USDA, USDI Species Review Panel 1999b and 2000b). *Tritomaria exsectiformis* was included in the Rare Species group for the FEMAT analysis, and was rated as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands; and was given a high likelihood of being confined to refugia or extirpated (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Current information suggests that *Tritomaria exsectiformis* has a limited geographic distribution, its distribution is limited to a small portion within its range, and it occurs in isolated site clusters where it does exist.

*Rhizomnium nudum* has a North Pacific distribution; it occurs from Kamchatka and Japan east to the northwest coast of North America, and south from Alaska to northern Oregon (USDA, USDI 1998f and USDA, USDI Species Review Panel 1999b). Most of the sites reported for this species are in the Olympic Mountains and northern Washington Cascades, although the majority of collections (48) date prior to 1980 (USDA, USDI Species Review Panel 1999b). There is no information on whether the species is extant at these historic sites. There are 16 sites reported from federally managed land since 1993 (USDA, USDI Species Review Panel 2000b). Current information suggests that *Rhizomnium nudum* has a moderate geographic range within the Northwest Forest Plan area, with a widespread but spotty distribution within its range, and it occurs in isolated site clusters.

Because of concerns for rarity, these species were included in the Survey and Manage Standards and Guidelines of the Northwest Forest Plan (USDA, USDI 1994b), except *Rhizomnium nudum*. *Rhizomnium nudum* is not a Survey and Manage species, but was included as a Protection Buffer species in the Scientific Analysis Team Report (Appendix 5-H in Thomas et al. 1993) and in the Northwest Forest Plan (USDA, USDI 1994b, p. C-27) because of concerns for its rarity.

Pre-disturbance surveys are considered not practical for these species, given the difficulty locating and identifying them in the field, and the potential difficulty in accurately identifying specimens, even by skilled taxonomists. There is no substantial new information that would change the assumptions and effects analysis of the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b).

### Environmental Consequences and Comparison of Alternatives

Management is similar for these five species under the No-Action Alternative. *Diplophyllum plicatum*, *Kurzia makinoana*, *Marsupella emarginata* var. *aquatica*, and *Tritomaria exsectiformis* are in Categories 1 and 2; *Rhizomnium nudum* is a Protection Buffer species. Under the No-Action Alternative, all current and future known sites would be managed and surveys would be conducted prior to habitat-disturbing activities.

Under Alternative 1, these species would be in Category 1B. Under Alternative 2 they would be in Category 2B. Management direction for these categories would be identical. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for these species given the difficulty locating and identifying them in the field (USDA, USDI Species Review Panel 1999b). Strategic surveys would be conducted to find additional sites and to address species information and management needs.

Under Alternative 3, these species would be in Category 3A. In this category, all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would

be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for these five species is required under all alternatives. Management would be the same under the No-Action Alternative and Alternatives 1 and 2 (i.e., management would be to maintain the species at the site). The prescribed area for management of known sites under Alternative 3, a 250-meter buffer, could provide larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. However, if these species are thought to require interior microclimate, there would be little difference between site management under all alternatives, because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3. Under all alternatives, managing known sites would help maintain the current distribution of these species. However, because these species have limited distributions, and are known from so few sites, managing known sites alone may not provide for stable populations of these species on federally managed lands throughout the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for these species under Alternative 3. However, because these surveys would be conducted relative to project areas, which may not be in the most likely habitat, and because of the difficulty in finding or identifying these species, these surveys would likely provide only limited additional information for management. Sites that would be discovered as a result of equivalent-effort surveys would be managed and would contribute to maintaining the current distribution of populations of the species. Because the current known sites of these species are limited in distribution, any newly located sites could be important to maintaining these species in stable populations across their range in the Northwest Forest Plan area. There would be some risk of loss of sites under Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted.

Strategic surveys would be conducted under all three action alternatives. These surveys could address questions for managing these five species and focus on likely habitat where the species may occur. Strategic surveys would provide the information necessary to determine the appropriate management to reduce concerns for these species.

Strategic surveys would not be conducted for these five species in the No-Action Alternative. This would limit the amount of information collected for these species to the type of information collected during pre-disturbance surveys only. Discovery of known sites would be limited primarily to those areas where projects occur. It would be difficult to address the fundamental questions of the Survey and Manage criteria; that is, whether reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide for these species and whether they are late-successional or old-growth associated species. It would also be difficult to gather the information necessary to determine the appropriate management to maintain populations. This is because information on these species would be acquired only through pre-disturbance surveys which would be limited in geographic extent, and the kinds of information collected would be insufficient to address the above questions.

These species are known from few sites, and current information indicates they are rare and limited in distribution. However, because there have been limited survey efforts for these species, it is unknown how well the current knowledge of these species reflects their rarity or distribution patterns. Management of known sites under all alternatives will contribute to providing for stable populations of these species. In addition, strategic surveys under the action alternatives may locate additional sites that will be managed to maintain the species at the site. Strategic surveys could also provide information necessary to determine the appropriate management to reduce concerns for these species. Because surveys for these species are limited to project areas under the No-Action Alternative, there is a lower likelihood of locating additional known sites, and a greater uncertainty of maintaining populations under the No-Action Alternative compared to the action alternatives.

In conclusion, there is insufficient information to determine how any alternative would affect the distribution and stability for *Kurzia makinoana*, *Marsupella emarginata* var. *aquatica*, and *Tritomaria exsectiformis* because of the few known sites, lack of knowledge, and taxonomic issues for *Kurzia makinoana* and *Marsupella emarginata* var. *aquatica*. For *Rhizomnium nudum*, while there is a moderate level of uncertainty due to lack of knowledge, all alternatives would provide sufficient habitat (including known sites) for *Rhizomnium nudum* to stabilize in a pattern similar to its reference distribution. For *Diplophyllum plicatum*, the same conclusion applies, but with a high level of uncertainty.

### ***Orthodontium gracile***

#### **Background and Affected Environment**

*Orthodontium gracile* has a broad, global distribution, occurring in England, France, Australia, and the west coast of North America. In North America, it is known only from the coastal redwood forests in southern Oregon and northwestern California (Christy and Wagner 1996). The ISMS database shows 27 records for this species prior to 1993, with no recent collections (USDA, USDI Species Review Panel 2000b and Table F-2). Only two sites for this species are known from federally managed land (USDA, USDI 1996). A recent attempt to relocate the species at the two historical locations in southern Oregon was unsuccessful, but a different species of the genus was found, *Orthodontium lineare* (USDA, USDI Species Review Panel 2000b). It is uncertain if *Orthodontium gracile* is extant in southern Oregon, and now there is uncertainty regarding the identification of voucher specimens for *Orthodontium gracile* from the Northwest Forest Plan area (USDA, USDI Species Review Panel 2000b). When the herbaria search was conducted several years ago, the only *Orthodontium* species thought to occur in the Northwest Forest Plan area was *Orthodontium gracile*, so the identification of the specimens labeled as *Orthodontium gracile* was not verified at that time (USDA, USDI Species Review Panel 2000b). Current information suggests that the geographic range of this species is very limited in the Northwest Forest Plan area, and its distribution is limited to a small portion within its range. Its biological distribution is unknown.

Pre-disturbance surveys are considered not practical for this species given the difficulty with identifying it in the field. This is because microscopic examination is necessary to observe distinguishing features, reproductive structures are necessary for species identification, and there is potential difficulty in accurately identifying specimens, even by skilled taxonomists (USDA, USDI Species Review Panel 2000b and 2000c).

#### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, *Orthodontium gracile* is in Categories 1 and 3. Under these categories, all current and future known sites would be managed and extensive surveys would be required for this species. Surveys prior to habitat-disturbing activities would not be required.

*Orthodontium gracile* is in Category 1B under Alternative 1 and Category 2B under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed. Strategic surveys would be conducted to locate additional sites and to address species information and management needs.

Under Alternative 3, *Orthodontium gracile* is in Category 3A. Under this category, all current and future known sites would be managed with a 250-meter buffer, equivalent-effort pre-disturbance surveys would be conducted, and strategic surveys would be required.

Management of all known sites for *Orthodontium gracile* occurs under all alternatives, although there may be some differences in site management between alternatives. Management recommendations would direct the management of known sites. Under the No-Action Alternative and Alternatives 1 and 2, management would be the same (i.e., management would be to maintain the species at the site). The prescribed area for known sites under Alternative 3 may provide

larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. If the species is thought to require interior microclimate, there would be little difference between site management under all alternatives. The area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3. Because this species has a limited number of known sites and limited amount of potential habitat on federally managed land, management of known sites alone may not provide for stable populations of this species on federally managed land throughout the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for this species under Alternative 3. Because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, and because of the difficulty with finding and accurately identifying this species, these surveys would likely provide only limited additional information for management. Sites discovered as a result of pre-disturbance surveys would be managed and would contribute to maintaining the current distribution of the species. Because the current known sites of this species are limited in distribution, few sites occur on federally managed land, and suitable habitat is limited on federally managed land, any new sites located are likely to be important in contributing towards maintaining stable populations of this species across its range in the Northwest Forest Plan area. There would be some risk of loss of sites under the No-Action Alternative and Alternatives 1 and 2, because surveys prior to habitat-disturbing activities would not be conducted. This could result in a loss of sites that may be important to maintaining stable populations of *Orthodontium gracile* across its range under the No-Action Alternative and Alternatives 1 and 2. However, given the limited suitable habitat available on federally managed lands, pre-disturbance surveys would be unlikely to locate many new sites.

Strategic surveys would be required in all alternatives to gather the information needed to manage this species to maintain stable populations across its range in the Northwest Forest Plan area. These surveys would address questions for managing this species and focus on likely habitat where the species may occur. Strategic surveys would also provide the information necessary to determine the appropriate management to reduce concerns for *Orthodontium gracile* in the Northwest Forest Plan area.

There is a moderate to high level of uncertainty regarding the status of *Orthodontium gracile* in the Northwest Forest Plan area. It is uncertain if *Orthodontium gracile* is extant in southern Oregon, and now there is uncertainty regarding the identification of voucher specimens for *Orthodontium gracile* from the Northwest Forest Plan area (USDA, USDI Species Review Panel 2000b). Assuming the herbaria specimens were correctly identified as *Orthodontium gracile*, the distribution of this species on federally managed land is limited with only two known sites, both dating prior to 1993. In addition, current information indicates that *Orthodontium gracile* has a narrow ecological amplitude, occurring only in coastal redwood forests, and the amount of this habitat on federally managed lands is limited. For these reasons, there is insufficient information regarding *Orthodontium gracile* to determine how any alternative would affect its distribution and stability.

***Encalypta brevicolla* var. *crumiana*, *Herbertus aduncus*, *Iwatsukiella leucotricha*, *Racomitrium aquaticum*, and *Tritomaria quinquedentata***

### **Background and Affected Environment**

*Encalypta brevicolla* var. *crumiana* is endemic to the Pacific Northwest where it is known only from two historical collections in the Northwest Forest Plan area (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b). Current information suggests that the geographic range of this species is extremely limited and its distribution is limited to a small portion within its range. Its biological distribution is unknown. This taxon may not meet the criterion for close association with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). The genus is difficult to identify in the field by experts if the sporophyte is not present. Detailed and intensive microscopic examination is essential to identify the taxon (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b).

*Herbertus aduncus* is circumboreal (occurs at northern latitudes), and is known in western North America from Alaska south to Oregon. The species is abundant in British Columbia, becomes rare in Washington, and is very rare in Oregon (Christy and Wagner 1996 and USDA, USDI 1996). It is reported from four localities in the Northwest Forest Plan area, three of which occur on federally managed land (USDA, USDI 1996); there are no recent sites. Habitat data is limited (USDA, USDI Species Review Panel 1999b). Current information suggests that *Herbertus aduncus* has a limited geographic range within the Northwest Forest Plan area, and its distribution is limited to a small portion within this range where it occurs in isolated sites.

*Iwatsukiella leucotricha* occurs in Asia and the Pacific Northwest. There are only two known sites in the Northwest Forest Plan area, and no recent sites are reported (see Table F-2). The two sites are in northwestern Oregon and are not on federally managed land. Habitat information is limited (USDA, USDI Species Review Panel 1999b). Current information suggests that *Iwatsukiella leucotricha* has an extremely limited geographic range within the Northwest Forest Plan area, and its distribution is limited to a small portion within this range where it occurs in isolated sites.

*Racomitrium aquaticum* has a broad global distribution (Christy and Wagner 1996). In the Pacific Northwest it is known from the Coast and Cascade Ranges, and from the Siskiyou and Klamath Mountains, ranging from northern California to Alaska (USDA, USDI 1996). It is reported from 30 sites in the Northwest Forest Plan area; 6 of these sites have been reported since 1993 (USDA, USDI Species Review Panel 1999b and Table F-2). Habitat information is limited (Christy and Wagner 1996). The genus *Racomitrium* is difficult to identify. There is uncertainty surrounding the identification for some collections from known sites. Until these collections are verified, the number of known sites and the distribution of this species within the Northwest Forest Plan area is unknown (Step 2 panel notes 1999, Christy and Wagner 1996.)

*Tritomaria quinqueidentata* has a circumboreal distribution. It is known in the Pacific Northwest from northwestern Washington and northwestern Oregon (Christy and Wagner 1996; USDA, USDI 1996; and USDA, USDI Species Review Panel 1999b). It is known from four sites within the Northwest Forest Plan area and there are no sites reported since 1993 (USDA, USDI 1996; USDA, USDI Species Review Panel 1999b; and Table F-2). Habitat data is limited (Christy and Wagner 1996). The association of this species with late-successional or old-growth forests is uncertain (USDA, USDI Species Review Panel 1999b). Current information suggests that this species has a very limited geographic range within the Northwest Forest Plan area, and its distribution is limited to a small portion within this range where it occurs in isolated sites.

Pre-disturbance surveys are considered not practical for these species, given the difficulty locating and identifying them in the field, and the potential difficulty in accurately identifying specimens, even by skilled taxonomists. There is no substantial new information that would change the assumptions and effects analysis of the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b).

### Environmental Consequences and Comparison of Alternatives

Management is similar for these five species under the No-Action Alternative. *Encalypta brevicolla* var. *crumiana*, *Herbertus aduncus*, *Iwatsukiella leucotricha*, *Racomitrium aquaticum*, and *Tritomaria quinqueidentata* are in Categories 1 and 3. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

These species would be in Category 1B under Alternative 1 and Category 2B under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed. Strategic surveys would be conducted to find additional sites and to address species information and management needs.

Under Alternative 3 these species would be in Category 3A. In this category, all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be

conducted with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to find additional sites and to address species information and management needs.

Management of known sites for these five species is required under all alternatives. Management of known sites under the No-Action Alternative and Alternatives 1 and 2 would be the same (i.e., management would be to maintain the species at the site). The prescribed area for known sites under Alternative 3, a 250-meter buffer, could provide larger habitat areas for recruitment and expansion of the population, and could result in larger or more stable populations over time. However, if the species is thought to require interior microclimate, there would be little difference between site management under the action alternatives because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3. Management of known sites would help maintain the current distribution of populations. Because these species have limited distributions and few sites on federally managed land, management of known sites alone may not be able to provide for stable populations of these species throughout the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for these five species under Alternative 3. Because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, and because of the difficulty in finding or identifying these species, equivalent-effort surveys would likely provide only limited additional information for management. Sites discovered as a result of equivalent-effort surveys would be managed and would contribute to maintaining the current distribution of populations of the species. There is some risk of loss of sites under the No-Action Alternative and Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted. This could result in a loss of sites that may be important to maintaining stable populations of these species across their range.

Strategic surveys would be conducted under all three action alternatives, and extensive surveys under the No-Action Alternative. These surveys would focus on likely habitats where the species may occur with the objective of finding additional sites. Strategic surveys would provide the information necessary to determine the appropriate management to reduce concerns for these species.

These species are known from few sites and current information indicates they are rare and limited in distribution. However, there have been limited survey efforts for these species, and it is unknown how well the current knowledge of these species reflects their rarity or distribution patterns. Management of known sites under all alternatives will contribute to providing for stable populations of these species at the known sites. In addition, strategic surveys under the action alternatives may locate additional sites that will be managed to maintain the species. Because of the low number of known sites, there is insufficient information regarding these species to determine how any alternative would affect their distribution and stability.

The No-Action, and Alternatives 1 and 2 are similar in their provisions for these species. There may be less risk for these species under Alternative 3 because of the provision of equivalent-effort surveys that could minimize inadvertent loss of undiscovered sites in areas subject to habitat-disturbing activities.

### ***Tetraphis geniculata***

#### **Background and Affected Environment**

*Tetraphis geniculata* occurs in the Russian Far East, Japan, the Pacific Northwest, New England, and the Canadian Maritime Provinces (Christy and Wagner 1996). The number of known sites in the Northwest Forest Plan area, has increased from 6 to 31 since 1993, with 24 recent federal sites (USDA, USDI Species Review Panel 1999b and 2000b, and Table F-2). It has been reported from late-successional and old-growth forests; from younger stands in cool, moist sites; and on large

logs that were derived from older forests (USDA, USDI 1999d). It has a spotty distribution, and where it occurs, it is often associated with a closely related species, *Tetraphis pellucida* (Christy and Wagner 1996; USDA, USDI 1996; USDA, USDI 1999d; and USDA, USDI Species Review Panel 1999b). Current information suggests that *Tetraphis geniculata* has a moderate geographic range within the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated site clusters.

*Tetraphis geniculata* was not rated by the FEMAT bryophyte panel because it was poorly known (USDA et al. 1993). *Tetraphis geniculata* was included as a Protection Buffer species (Appendix 5-H in Thomas et al. 1993 and USDA, USDI 1994b, p. C-27) because of its rarity. It was also included under the Survey and Manage Standards and Guidelines because of concerns based on its rarity. There is no substantial new information that would change the assumptions and effects analysis of the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b). This species is still considered to be rare, with a limited distribution within the Northwest Forest Plan area.

### Environmental Consequences and Comparison of Alternatives

In the No-Action Alternative, *Tetraphis geniculata* is a Protection Buffer species, and in Survey and Manage Categories 1 and 3. Under Categories 1 and 3, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be selected for management. In addition, as a Protection Buffer species, surveys are required before habitat-disturbing activities.

*Tetraphis geniculata* is in Category 1A under Alternative 1 and 2A under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed and pre-disturbance surveys would be conducted. Strategic surveys would be conducted to address species information and management needs. Under Alternative 3, *Tetraphis geniculata* is in Category 3A. Under this category, all current and future known sites would be managed with a 250-meter buffer, pre-disturbance surveys would be conducted, and strategic surveys would be required.

Management of all known sites for *Tetraphis geniculata* occurs under all alternatives. Known site management would be the same under the No-Action Alternative and Alternatives 1 and 2 management (i.e., management would be to maintain species at the site). The prescribed area for known sites under Alternative 3, a 250-meter buffer, could provide larger habitat areas for recruitment and expansion of the population, and could result in larger or more stable populations over time. If the species is thought to require interior microclimate, there would be little difference between site management under the action alternatives because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3. However, because this species has a limited distribution in the Northwest Forest Plan area, management of known sites alone may not be able to provide for stable populations of this species.

All alternatives require pre-disturbance surveys, which may discover additional sites of *Tetraphis geniculata* if it occurs in project areas. In the absence of sporophytes, *Tetraphis geniculata* cannot be distinguished from a closely-related, common, and widespread species *Tetraphis pellucida*. Because pre-disturbance surveys would be conducted only in project areas and not in likely habitat, these surveys would provide only limited additional information for management. Sites that would be discovered by these surveys would be managed and contribute to the distribution of populations across its range in the Northwest Forest Plan area.

Strategic surveys would be required in all action alternatives, and extensive surveys under the No-Action Alternative, to gather the information needed to manage this species to maintain stable populations across its range in the Northwest Forest Plan area. Strategic surveys could be effective in maintaining the species because they would be conducted in areas with a high likelihood of locating the species, provide information that can assist in management of the species, and narrow the habitat where pre-disturbance surveys would be required. Strategic

surveys could assist in providing the information necessary to determine the appropriate management to reduce concerns for *Tetraphis geniculata*.

*Tetraphis geniculata* is known from few sites in the Northwest Forest Plan area. However, new sites have been found in the recent years with only limited survey effort. It is possible that additional surveys under all alternatives will locate new sites that can contribute to providing for a stable population of this species. All alternatives are similar in management of this species through pre-disturbance and strategic surveys, and management of known sites. It is uncertain, however, how many additional sites of this species will be found through surveys, and whether *Tetraphis geniculata* has the potential to maintain stable populations across its range. While there is a moderate level of uncertainty (due to lack of information, species rarity, and limited distribution) all alternatives would provide sufficient habitat (including known sites) to allow *Tetraphis geniculata* to stabilize in a pattern similar to its reference distribution in the Northwest Forest Plan area.

### ***Schistostega pennata***

#### **Background and Affected Environment**

*Schistostega pennata* is a circumboreal species (occurs at northern latitudes), known in this region from British Columbia, Alberta, Montana, Washington, and Oregon (Christy and Wagner 1996 and USDA, USDI 1999d). It is reported from 26 sites within the Northwest Forest Plan area; 16 are recent federal sites (USDI Species Review Panel 2000b and Table F-2). During the FEMAT analysis, it was only known from Washington. It was reported in 1998 from Douglas and Lincoln Counties in Oregon, which extended the known range of the species (USDA, USDI 1999d and USDA, USDI Species Review Panel 1999b). Current information suggests that *Schistostega pennata* has a moderate geographic range within the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated sites or isolated site clusters.

*Schistostega pennata* is considered a rare species in the Northwest Forest Plan area (USDA et al. 1993; Christy and Wagner 1996; and USDA, USDI 1996). *Schistostega pennata* was included in the Rare Species group by the FEMAT bryophyte panel, and was rated as having a high likelihood of having habitat of sufficient quality, distribution, and abundance to support a stable, well-distributed population across federally managed lands. This rating reflected a high level of confidence the species would be well distributed due to prescriptions for riparian areas. However, concerns for its rarity were noted in the Scientific Analysis Team Report, and *Schistostega pennata* was included as a Protection Buffer species (Appendix 5-H in Thomas et al. 1993) in the Northwest Forest Plan. Knowledge of the distribution and habitat of the species has increased since FEMAT, although there are still few known sites in the region (USDA, USDI Species Review Panel 1999b and 2000b, and USDA, USDI 1999d). There is no substantial new information that would change the assumptions and effects analyses of the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b).

#### **Environmental Consequences and Comparison of Alternatives**

In the No-Action Alternative, *Schistostega pennata* is a Protection Buffer species. All current and future known sites would be managed and pre-disturbance surveys would be required before habitat-disturbing activities. *Schistostega pennata* is in Category 1A under Alternative 1 and Category 2A under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed and pre-disturbance surveys would be conducted. Strategic surveys would be conducted to find additional sites, and to address species information and management needs. Under Alternative 3, *Schistostega pennata* is in Category 3A. Under this category, all current and future known sites would be managed with a 250-meter buffer, pre-disturbance surveys would be conducted, and strategic surveys would be required.

Management of all known sites for *Schistostega pennata* occurs under all alternatives, and would be similar. Under the No-Action Alternative and Alternatives 1 and 2, management would be to



maintain the species at the site. The prescribed area for known sites under Alternative 3, a 250-meter buffer, could provide larger habitat areas for recruitment and expansion of the population, and could result in larger or more stable populations over time. If the species is thought to require interior microclimate, there would be little difference between site management under all alternatives, because the area necessary to provide for interior microclimate conditions would be similar to the area provided under Alternative 3. Because this species has a limited distribution, management of known sites alone may not provide for stable populations of this species throughout the Northwest Forest Plan area.

All alternatives require pre-disturbance surveys, which would be likely to discover additional sites of the species if they occur in project areas. However, because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, these surveys may provide only limited additional information for management. Sites that would be discovered by these surveys would be managed, and would contribute to the distribution of populations across its range in the Northwest Forest Plan area.

Strategic surveys would be conducted for *Schistostega pennata* under all three action alternatives. These surveys would address the questions for the management of this species, and would focus on likely habitats where the species may occur. They would gather information needed to manage this species to maintain stable populations across its range in the Northwest Forest Plan area. Strategic surveys would be conducted in areas with high likelihood of locating the species; provide information that can assist in management of the species; and, narrow the habitat where pre-disturbance surveys would be required.

Strategic surveys would not be conducted for *Schistostega pennata* in the No-Action Alternative. This would limit the amount of information collected on this species to pre-disturbance surveys only. Because discovery of known sites would be limited primarily to those areas where projects occur, it would be difficult to address one of the fundamental questions of the Survey and Manage Standards and Guidelines, that is, do the reserve land allocations and other Standards and Guidelines of the Northwest Forest Plan provide for this species. Also, it would be difficult to gather the information necessary to determine what the concerns would be for the species and what management is needed to provide for stable populations across its range in the Northwest Forest Plan area.

*Schistostega pennata* is known from few sites in the Northwest Forest Plan area. However, new sites have been found in recent years with only limited survey effort. It is possible that additional surveys under all alternatives will locate new sites that can contribute to providing a stable population of this species. All alternatives are similar in providing for this species through pre-disturbance surveys and management of known sites. However, only the action alternatives require strategic surveys, which are likely to find additional sites that may not have been located in the No-Action Alternative. The risk to this species may be somewhat lower under the action alternatives because of the strategic survey requirement; sites discovered through strategic surveys may be important in contributing to a stable population of *Schistostega pennata* throughout the Northwest Forest Plan area. It is uncertain how many additional sites of this species will be found through surveys, and whether *Schistostega pennata* has the potential to maintain stable populations across its range. While there is a moderate level of uncertainty (due to lack of information, species rarity, and limited distribution) all alternatives would provide sufficient habitat (including known sites) to allow *Schistostega pennata* to stabilize in a pattern similar to its reference distribution in the Northwest Forest Plan area, although the uncertainty is higher under the No-Action Alternative.

### ***Diplophyllum albicans***

#### **Background and Affected Environment**

*Diplophyllum albicans* has a circumboreal (occurs at northern latitudes) distribution (Christy and Wagner 1996). Within the Northwest Forest Plan area, it occurs along the coast and west of the

Cascade Crest (USDA, USDI Species Review Panel 1999b). The majority of known sites are reported from herbaria collections made prior to 1993. It is known from 65 sites in the Northwest Forest Plan area; 3 are recent federal sites reported since 1993 (USDA, USDI Species Review Panel 1999b and Table F-2). The species is widespread, but patchy in its distribution (Christy and Wagner 1996 and USDA, USDI 1996). This species is reported as abundant in forested regions, but its ability to occur on a variety of substrates and stand ages indicate it may not be closely associated with late-successional or old-growth forests (Christy and Wagner 1996 and USDA, USDI Species Review Panel 1999b). Current information suggests that *Diplophyllum albicans* has a widespread geographic range, its distribution is considered to be widespread but spotty within the Northwest Forest Plan area, and it occurs in isolated site clusters.

*Diplophyllum albicans* was described as most common in the Coast Range in the Sitka Spruce Zone and infrequent outside of the coastal strip (USDA et al. 1993 and USDA, USDI 1996). Additional information now indicates that it may be sufficiently common to not require site-specific protection of all known sites (Christy and Wagner 1996; USDA, USDI 1996; and USDA, USDI Species Review Panel 1999b, 1999c, and 2000c).

The number and distribution of known sites, and its occurrence outside of the Sitka Spruce Zone, as well as questions regarding its association with late-successional or old-growth forests, may change some of the assumptions in previous analyses. This new information indicates that it may be sufficiently common to not require management of all known sites to provide for stable populations on federally managed lands in the Northwest Forest Plan area.

### Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, *Diplophyllum albicans* is in Survey and Manage Categories 1 and 3. Under Categories 1 and 3, all current and future known sites would be managed, extensive surveys would be required for the species, and high-priority sites would be selected for management. Under Alternative 1, *Diplophyllum albicans* is in Category 1D. This category requires management of high-priority sites. Strategic surveys would be conducted to address species information and management needs. Under Alternative 2, *Diplophyllum albicans* is in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Based on strategic survey information, the species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions are needed. Under Alternative 3, *Diplophyllum albicans* is in Category 3B. This category requires management of high-priority sites, equivalent-effort surveys, and strategic surveys.

Known site management varies for *Diplophyllum albicans* in the different alternatives. The No-Action Alternative provides the greatest site protection as all current and future known sites would be managed. Under Alternatives 1 and 3, only high-priority sites would be managed. The Management Recommendation for *Diplophyllum albicans* would identify high-priority sites, but until the Management Recommendation is approved, all known sites would be managed. Sites considered not necessary for maintaining stable populations on federally managed lands would not be managed under Alternatives 1 and 3. The least site protection occurs under Alternative 2, where only the sites known as of September 30, 1999, would be managed. This could result in loss of sites that may be necessary for maintaining this species well distributed throughout its range in the Northwest Forest Plan area. There is also concern because the majority of known sites for *Diplophyllum albicans* are reported prior to 1993, with only three recent sites documented on federally managed land. It is not known how many of these older sites are still extant. After completion of strategic surveys within 5 years, the species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Equivalent-effort surveys prior to habitat-disturbing activities are required for *Diplophyllum albicans* only under Alternative 3. Pre-disturbance surveys are considered not practical under the other alternatives. These surveys would be conducted relative to project locations, which may not

be in the most likely habitat. However, sites that are discovered would be managed if they were identified as high-priority sites. The absence of pre-disturbance surveys in the other three alternatives may result in a moderate to high increase in the uncertainty of providing for stable populations of *Diplophyllum albicans*, if the potential lost sites occur within a portion of the species range where additional populations would be important to provide for its distribution and abundance.

Strategic surveys would be conducted for *Diplophyllum albicans* under all three action alternatives, and as extensive surveys under the No-Action Alternative. These surveys would address the questions for the management of this species, and could focus on likely habitats where the species may occur. They would gather information needed to manage this species to maintain stable populations across its range in the Northwest Forest Plan area. Strategic surveys would be effective in providing for the species as they can be conducted in areas with high likelihood of locating the species, and provide information that can assist in management of the species.

The four alternatives differ in the level of concern and uncertainty for maintaining stable populations of *Diplophyllum albicans* across its range in the Northwest Forest Plan area. Alternative 2 has the highest level of uncertainty for this species stability because only the sites known as of September 30, 1999, are managed and it is unknown how many of these sites are extant since all but three were reported prior to 1993. This limitation on known site management under Alternative 2 could result in loss of sites that may be necessary for maintaining this species throughout its range in the Northwest Forest Plan area. The No-Action Alternative provides the greatest site protection, as all current and future known sites would be managed. There is an increased risk for the species under the action alternatives compared to the No-Action Alternative, because of the provision to manage high-priority sites. However, it was determined that because of the distribution and number of sites of the species, not all sites may be necessary to maintain stable populations. Of the action alternatives, Alternative 3 has the least risk to the species because of the provision for pre-disturbance surveys that have the potential to locate additional populations that would be important in contributing to a stable population of *Diplophyllum albicans*.

While there is a moderate level of uncertainty (due to lack of knowledge and only three recent federal sites), the No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) for *Diplophyllum albicans* to stabilize in a pattern similar to its reference distribution. There is a high degree of uncertainty of this outcome under Alternative 2 because of the limits placed on known site management.

### ***Buxbaumia viridis***

#### **Background and Affected Environment**

*Buxbaumia viridis* has a broad global distribution and is reported from North America, Europe, Russia, China, Japan, North Asia, and New Zealand. In North America, it occurs in British Columbia, Alberta, Montana, Idaho, Colorado, Washington, and Oregon (Christy and Wagner 1996; USDA, USDI 1996; USDA, USDI 1999d; and USDA, USDI Species Review Panel 1999b). It is documented from northern Washington into southern Oregon, and on both sides of the Cascades (USDA, USDI 1999d and USDA, USDI Species Review Panel 1999b and 2000b). The distribution is somewhat patchy, although this may reflect levels of survey and the difficulty in locating the species in the field because it is small and inconspicuous, and its identifying structures are ephemeral (USDA, USDI 1996 and USDA, USDI Species Review Panel 1999b). The species has a broad ecological distribution, occurring from sea level to subalpine elevations (Christy and Wagner 1996; USDA, USDI 1996; and USDA, USDI 1999d). Current information suggests that *Buxbaumia viridis* has a widespread geographic range and has a widespread but spotty distribution within its range in the Northwest Forest Plan area. Its biological distribution is unknown at this time.

*Buxbaumia viridis* was included in the Decaying Wood-Less Common group and was rated as having a high likelihood of having habitat of sufficient quality, distribution, and abundance to

support a stable, well-distributed population across federally managed lands (USDA et al. 1993). This species appears to be dependent on a continuous supply of large, well-decayed logs for persistence (Christy and Wagner 1996 and USDA, USDI 1996). However, because of concerns for its rarity, *Buxbaumia viridis* was included as a Protection Buffer species in the Scientific Analysis Team Report (Appendix 5-H in Thomas et al. 1993) and in the Northwest Forest Plan (USDA, USDI 1994b, p. C-27).

The number of known sites has greatly increased for *Buxbaumia viridis* since the FEMAT analysis. Since 1993, known sites for *Buxbaumia viridis* have increased from 14 to 327, with 283 recent federal sites. The majority of sites are recorded since 1997 and were detected during pre-disturbance surveys. The increase in the number of known sites since 1993 may reduce the level of concern for this species, and it may not be as rare as previously thought (USDA, USDI Species Review Panel 1999b and 2000b).

Despite the large number of sites discovered for this species through pre-disturbance surveys, *Buxbaumia viridis* was considered not practical to survey for prior to habitat-disturbing activities (USDA, USDI Species Review Panel 1999b, 1999c, 2000b, and 2000c). The physical features necessary to identify *Buxbaumia viridis* are ephemeral and unpredictable, and the plant is small and inconspicuous; it could easily be missed during surveys. It may take multiple years at an individual site to locate the species in the correct state of development. Because of these reasons, there is uncertainty detecting the presence of *Buxbaumia viridis* at a site during pre-disturbance surveys.

### Environmental Consequences and Comparison of Alternatives

*Buxbaumia viridis* is a Protection Buffer species in the No-Action Alternative. Under the No-Action Alternative, all current and future known sites would be managed and pre-disturbance surveys would be conducted prior to habitat-disturbing activities. Under Alternative 1, *Buxbaumia viridis* is in Category 1D. This category requires management of high-priority sites and strategic surveys would be conducted to address species information and management needs. Under Alternative 2, *Buxbaumia viridis* is in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Based on strategic survey information, the species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. Under Alternative 3, *Buxbaumia viridis* is in Category 3B. This category requires management of high-priority sites, equivalent-effort surveys, and strategic surveys.

Known site management varies for *Buxbaumia viridis* in the different alternatives. The No-Action Alternative provides the greatest site protection as all current and future known sites would be managed. Under Alternatives 1 and 3, only the high-priority sites would be managed, but all known sites would be managed until the Management Recommendation is completed. Sites considered not necessary for maintaining stable populations on federally managed lands would not be managed under Alternatives 1 and 3. The least amount of site protection occurs under Alternative 2, where only the sites known as of September 30, 1999, would be managed. This could result in loss of sites that may be necessary for maintaining this species well distributed throughout its range in the Northwest Forest Plan area. After 5 years, following completion of strategic surveys, the species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Pre-disturbance surveys are required for *Buxbaumia viridis* under the No-Action Alternative and Alternative 3. However, these surveys would be conducted relative to project locations which may not be in the most likely habitat. Sites that are discovered would be managed if they were identified as high-priority sites. The absence of pre-disturbance surveys in Alternatives 1 and 2 would only slightly increase the risk of not providing for stable populations of *Buxbaumia viridis* given the wide geographic and ecological distribution of this species. The absence of pre-

disturbance surveys in Alternatives 1 and 2 would only increase the risk if the loss of sites occurs within a portion of the range where additional sites would be necessary to provide for maintenance of populations of *Buxbaumia viridis*.

Strategic surveys would be required for *Buxbaumia viridis* under all three action alternatives, but are not required in the No-Action Alternative. However, under Alternative 2, these surveys would be completed in 5 years. Strategic surveys would: (1) determine what the level of concern is for *Buxbaumia viridis* throughout its range within the Northwest Forest Plan area; (2) determine if the reserve land allocations provide for the species; (3) identify high-priority sites for management; and, (4) determine what the appropriate management is for *Buxbaumia viridis* in order to maintain well-distributed populations throughout its range in the Northwest Forest Plan area.

Following completion of strategic surveys under Alternative 2, a recommendation would be made whether to include *Buxbaumia viridis* under the Agencies' special status species programs. The physical features necessary to identify *Buxbaumia viridis* are ephemeral and unpredictable, and the species could be easily missed during surveys. It may take multiple years at an individual site to locate the species in the correct stage of development. It is unlikely that all information would be available after 5 years, given the survey difficulties and the need to gather information for *Buxbaumia viridis* throughout its wide range, and the need to determine if the reserve land allocations provide for the species. This would make it difficult to determine the appropriate management that would be necessary to provide for well-distributed populations of *Buxbaumia viridis* in the 5-year timeframe.

The four alternatives differ in the level of concern and uncertainty for maintaining stable populations of *Buxbaumia viridis* across its range in the Northwest Forest Plan area. Alternative 2 has a moderate level of uncertainty for the species because only the sites known as of September 30, 1999, are managed. This could result in loss of sites that may be necessary for maintaining this species well-distributed throughout its range in the Northwest Forest Plan area. The No-Action Alternative provides the greatest protection; all current and future known sites would be managed, and pre-disturbance surveys are required so there is a decreased risk of loss of sites in project areas. There is a minor concern for the species under Alternatives 1 and 3 compared to the No-Action Alternative, because of the provision to manage high-priority sites. However, it was determined that not all sites are necessary to maintain stable populations, because of the distribution and number of sites of the species, and the large increase in number of sites in recent years. Of the action alternatives, Alternative 3 has the least risk to the species because of the provision for equivalent-effort surveys that have the potential to locate additional populations that would be important in contributing to stable populations of *Buxbaumia viridis*. In conclusion, The No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow *Buxbaumia viridis* to stabilize in a pattern similar to its reference distribution. This same conclusion applies to Alternative 2, however, with a moderate level of uncertainty because only sites known as of September 30, 1999, would be managed.

## Fungi

### Background and Affected Environment

Fungi are neither plants nor animals but are recognized as a separate kingdom of organisms, both in structure and function. The large number of macrofungi (fungi with sporocarps large enough to be seen without a hand lens) in late-successional and old-growth forests, especially in uneven-age stand structure, reflects the complexity of the late-successional and old-growth ecosystems as well as, or better than, many other groups of organisms. Estimates indicate there are at least six species of fungi for every vascular plant species in a given temperate ecosystem (Hawksworth 1991).

The fungal flora of the Pacific Northwest is extremely diverse. Of the 527 species of fungi that were evaluated as being closely associated with late-successional forests, 109 (21 percent) are known to be endemic to the Pacific Northwest. This list of species represents only a small

percentage of the macrofungi that occur in late-successional forests. If microfungi (fungi with small sporocarps that are seen only with a hand lens or microscope) were included, the list would be greatly expanded. For every group of fungi, there are many species, perhaps hundreds, in addition to those on the original list (USDA et al. 1993, Table IV-A-1, p. IV-213). Two hundred twenty-five species of fungi were included under the Survey and Manage Standards and Guidelines in the Northwest Forest Plan ROD (USDA, USDI 1994b, Table C-3). Since then, it has been determined that 7 species were duplicate names (see below) and they will be removed from Survey and Manage.

Fungi are essential to the functioning of forest ecosystems. Many of the forest fungi that produce large fruiting bodies (such as mushrooms, boletes, and coral fungi) have symbiotic relationships with vascular plants. The survival of most conifers and many flowering plants depends on associations with these mycorrhizal fungi for the uptake of nutrients and water (Trappe and Luoma 1992). Hypogeous fungi (fungi that fruit below ground) and certain mushrooms are important food for small mammals that, in turn, aid in spore dispersal. Saprobic fungi (fungi that live on dead or decaying organic matter) are a major component of all forest ecosystems, growing on recently fallen trees, well-decayed logs, litter, dung, etc. They play an important role in decomposition and nutrient recycling.

Most macrofungi (mushrooms, truffles, and allies) produce fruiting structures or sporocarps that are short-lived and ephemeral, seasonal in occurrence, and annually variable. Sporocarps for many species are produced only during a brief portion of the season, and may not be present at all in any given year. Richardson (1970) estimated that sampling every 2 weeks would fail to detect about 50 percent of macrofungal species fruiting in a season. The year-to-year variation in detecting a species at sites is very high for fungi. On the average, less than 10 percent of species were detected in each of 2 consecutive years at any 1 of 8 sites (O'Dell et al. 1999). In another study, about 50 percent of the species at a site were observed only during a single year, the 4th year (out of 5 years) of sampling (O'Dell, unpublished data). Because of this annual variability in sporocarp occurrence, for most fungi species 5 years or more of surveying at a site are necessary to reach a high probability of determining whether a species occurs at a site. The reasons for the annual and seasonal variation are not fully understood, and predicting when, or under what conditions, a species would fruit is not possible at present. It should be noted that a "good" year for fruiting of many species is not a good year for all species, and the fact that a species is observed at one site in a particular year does not guarantee that it will fruit that year at another site. This is a concern for all Survey and Manage fungi species except *Bridgeoporus nobilissimus*. In particular, the following seven species that require pre-disturbance surveys under the No-Action Alternative cannot be surveyed for in a single field season while meeting the criterion of "a high likelihood of detecting occupied sites" (USDA, USDI 1994b, pp. C-19 and C-27): *Bondarzewia mesenterica*, *Otidea leporina*, *Otidea onotica*, *Otidea smithii*, *Polyozellus multiplex*, *Sarcosoma mexicanum*, and *Sowerbyella rhenana*.

Another poorly understood facet of fungi is their population biology. Connectivity of populations across a landscape is key to species because this allows for the exchange of genetic material between subpopulations, reduces inbreeding, and prevents the accumulation of harmful alleles in isolated subpopulations. Dispersal, reproduction, and connectivity are not well-understood for any of the fungi considered herein. All of these species produce sporocarps that can in turn produce spores. It is often assumed that spores are the main unit of dispersal and reproduction in macrofungi. However, vegetative reproduction (by fragmenting hyphae or asexual spores) is probably an alternative for many species (Peterson and Hughes 1999). Spores can be aerially dispersed or moved by animals, with obvious differences in implications for population connectivity. If spores are moved by air currents over large distances, then isolation of subpopulations is less likely than if animal dispersal is required. Unfortunately, there is little specific data on dispersal mechanisms for macrofungi, although it is generally assumed that truffle fungi are dispersed by animals.

There is a high degree of uncertainty regarding the biological distribution of fungi. This is due to incomplete knowledge of species distributions and lack of specific information regarding dispersal

and other population biology characteristics for individual species. The reference distributions for fungi listed in Table C-3 (USDA, USDI 1994b) are displayed below.

The following species have highly isolated occurrences (sites), with little potential for gene flow between them. Several of these species are known from a single site.

<i>Acanthophysium farlowii</i>	<i>Albatrellus avellaneus</i>	<i>Albatrellus caeruleoporus</i>
<i>Albatrellus ellisii</i>	<i>Alpova alexsmithii</i>	<i>Alpova olivaceotinctus</i>
<i>Arcangeliella camphoratus</i>	<i>Arcangeliella crassa</i>	<i>Arcangeliella lactarioides</i>
<i>Asterophora lycoperdoides</i>	<i>Asterophora parasitica</i>	<i>Balsamia nigrens</i>
<i>Boletus haematinus</i>	<i>Boletus pulcherrimus</i>	<i>Bridgeoporus nobilissimus</i>
<i>Bryoglossum gracile</i>	<i>Catathelasma ventricosa</i>	<i>Chamonixia caespitosa</i>
<i>Choiromyces alveolatus</i>	<i>Choiromyces venosus</i>	<i>Chroogomphus loculatus</i>
<i>Chrysomphalina grossula</i>	<i>Clavariadelphus ligula</i>	<i>Clavariadelphus sachalinensis</i>
<i>Clavariadelphus subfastigiatus</i>	<i>Clavulina castanopes v. lignicola</i>	
<i>Clitocybe senilis</i>	<i>Clitocybe subditopoda</i>	<i>Collybia bakerensis</i>
<i>Collybia racemosa</i>	<i>Cordyceps capitata</i>	<i>Cordyceps ophioglossoides</i>
<i>Cortinarius boulderensis</i>	<i>Cortinarius cyanites</i>	<i>Cortinarius magnivelatus</i>
<i>Cortinarius speciosissimus</i>	<i>Cortinarius umidicola</i>	<i>Cortinarius valgis</i>
<i>Cortinarius variipes</i>	<i>Cortinarius verrucisporus</i>	<i>Cortinarius wiebeae</i>
<i>Craterellus tubaeformis</i>	<i>Cudonia monticola</i>	<i>Cyphellostereum laeve</i>
<i>Dermocybe humboldtensis</i>	<i>Destuntzia fusca</i>	<i>Destuntzia rubra</i>
<i>Dichostereum boreale</i>	<i>Elaphomyces anthracinus</i>	<i>Elaphomyces subviscidus</i>
<i>Endogone acrogena</i>	<i>Endogone oregonensis</i>	<i>Entoloma nitidum</i>
<i>Fayodia bisphaerigera</i>	<i>Fevansia aurantiaca</i>	<i>Galerina atkinsoniana</i>
<i>Gastroboletus imbellus</i>	<i>Gastroboletus ruber</i>	<i>Gastroboletus vividus</i>
<i>Gastrosuillus umbrinus</i>	<i>Gautieria magnicellaris</i>	<i>Gautieria otthii</i>
<i>Gelatinodiscus flavidus</i>	<i>Glomus radiatus</i>	<i>Gomphus bonarii</i>
<i>Gymnomyces abietis</i>	<i>Gymnomyces nondistincta</i>	<i>Gyromitra californica</i>
<i>Gyromitra melaleucoides</i>	<i>Hebeloma olympianum</i>	<i>Helvella crassitunicata</i>
<i>Helvella elastica</i>	<i>Helvella maculata</i>	<i>Hydnotrya inordinata</i>
<i>Hydnotrya subnix</i>	<i>Hydnum umbilicatum</i>	<i>Hygrophorus caeruleus</i>
<i>Hygrophorus vernalis</i>	<i>Hypomyces luteovirens</i>	<i>Leucogaster citrinus</i>
<i>Leucogaster microsporus</i>	<i>Macowanites chlorinosmus</i>	<i>Macowanites lymanensis</i>
<i>Macowanites mollis</i>	<i>Marasmius applanatipes</i>	<i>Martellia fragrans</i>
<i>Martellia idahoensis</i>	<i>Mycena hudsoniana</i>	<i>Mycena monticola</i>
<i>Mycena overholtsii</i>	<i>Mythicomycetes corneipes</i>	<i>Neolentinus adhaerens</i>
<i>Neolentinus kauffmanii</i>	<i>Neourmula pouchetii</i>	<i>Nivatogastrium nubigenum</i>
<i>Octavianina cyanescens</i>	<i>Octavianina macrospora</i>	<i>Octavianina papyracea</i>
<i>Otidea leporina</i>	<i>Otidea onotica</i>	<i>Otidea smithii</i>
<i>Phaeocollybia attenuata</i>	<i>Phaeocollybia californica</i>	<i>Phaeocollybia dissiliens</i>
<i>Phaeocollybia fallax</i>	<i>Phaeocollybia gregaria</i>	<i>Phaeocollybia kauffmanii</i>
<i>Phaeocollybia olivacea</i>	<i>Phaeocollybia oregonensis</i>	<i>Phaeocollybia piceae</i>
<i>Phaeocollybia pseudofestiva</i>	<i>Phaeocollybia sipei</i>	<i>Phaeocollybia spadicea</i>
<i>Pithya vulgaris</i>	<i>Plectania milleri</i>	<i>Podostroma alutaceum</i>
<i>Polyozellus multiplex</i>	<i>Pseudaleuria quinaultiana</i>	<i>Ramaria abietina</i>
<i>Ramaria amyloidea</i>	<i>Ramaria araiospora</i>	<i>Ramaria aurantiiscescens</i>
<i>Ramaria celerivirescens</i>	<i>Ramaria claviramulata</i>	<i>Ramaria concolor f. marrii</i>
<i>Ramaria concolor f. tsugina</i>	<i>Ramaria conjunctipes var. sparsiramosa</i>	
<i>Ramaria coulterae</i>	<i>Ramaria cyaneigranosa</i>	<i>Ramaria gelatiniaurantia</i>
<i>Ramaria gracilis</i>	<i>Ramaria hilaris var. olympiana</i>	<i>Ramaria largentii</i>
<i>Ramaria lorithamnus</i>	<i>Ramaria maculatipes</i>	<i>Ramaria rainierensis</i>
<i>Ramaria rubella var. blanda</i>	<i>Ramaria rubribrunnescens</i>	<i>Ramaria rubrievanescens</i>
<i>Ramaria spinulosa var. diminutiva</i>	<i>Ramaria stuntzii</i>	
<i>Ramaria suecica</i>	<i>Ramaria thiersii</i>	<i>Ramaria verlotensis</i>
<i>Rhizopogon abietis</i>	<i>Rhizopogon brunneiniger</i>	<i>Rhizopogon chamaleontinus</i>
<i>Rhizopogon ellipsosporus</i>	<i>Rhizopogon evadens var. subalpinus</i>	

<i>Rhizopogon exiguus</i>	<i>Rhizopogon flavofibrillosus</i>	<i>Rhizopogon inquinatus</i>
<i>Rhodocybe speciosa</i>	<i>Rickenella swartzii</i>	<i>Russula mustelina</i>
<i>Sarcodon fuscoindicus</i>	<i>Sarcosoma latahense</i>	<i>Sedecula pulvinata</i>
<i>Sowerbyella rhenana</i>	<i>Sparassis crispa</i>	<i>Spathularia flavida</i>
<i>Stagnicola perplexa</i>	<i>Thaxterogaster pavelekii</i>	<i>Tricholoma venenatum</i>
<i>Tricholomopsis fulvescens</i>	<i>Tuber asa</i>	<i>Tuber pacificum</i> .

The following species are distributed as groups or clusters of occurrences (isolated site clusters), with potential for gene flow among subpopulations within the groups and little potential for gene flow between the isolated groups:

<i>Albatrellus flettii</i>	<i>Baeospora myriadophylla</i>	<i>Chalciporus piperatus</i>
<i>Chromosera cyanophylla</i>	<i>Cortinarius olympianus</i>	<i>Galerina vittaeformis</i>
<i>Gyromitra infula</i>	<i>Hydopus marginellus</i>	<i>Mycena quinaultensis</i>
<i>Mycena tenax</i>	<i>Phellodon atratus</i>	<i>Pholiota albivelata</i>
<i>Plectania melastoma</i>	<i>Sarcosphaera eximia</i>	<i>Tylopilus porphyrosporus</i> .

The following species have patterns of distribution with limited potential for connectivity between isolated sites or site clusters:

<i>Cantharellus subalbidus</i>	<i>Clavariadelphus occidentalis</i>	<i>Clavariadelphus truncatus</i>
<i>Gastroboletus turbinatus</i>	<i>Gomphus clavatus</i>	<i>Gomphus kauffmanii</i>
<i>Gymnopilus punctifolius</i>	<i>Gyromitra montana</i>	<i>Martellia maculata</i>
<i>Ramaria botryis</i> var. <i>aurantiiramosa</i>	<i>Ramaria rubripermanens</i>	
<i>Sarcodon imbricatus</i>	<i>Tremiscus helvelloides</i> .	

The following species have multiple sites or clusters of sites that are nested within a web of potential interconnections:

<i>Bondarzewia mesenterica</i>	<i>Cantharellus formosus</i>	<i>Clavulina cristata</i>
<i>Gastroboletus subalpinus</i>	<i>Gomphus floccosus</i>	<i>Gyromitra esculenta</i>
<i>Helvella compressa</i>	<i>Hydnum repandum</i>	<i>Omphalina ericetorum</i>
<i>Rhizopogon parksii</i>	<i>Sarcosoma mexicanum</i>	<i>Thaxterogaster pingue</i> .

There is insufficient information to reach any conclusion regarding stability and distribution patterns for the following species:

<i>Cortinarius barlowensis</i>	<i>Cortinarius depauperatus</i>	<i>Cortinarius tabularis</i>
<i>Galerina cerina</i>	<i>Galerina heterocystis</i>	<i>Galerina sphagnicola</i>
<i>Hygrophorus karstenii</i>	<i>Phaeocollybia scatesiae</i>	<i>Rhizopogon atroviolaceus</i>
<i>Rhizopogon truncatus</i> .		

The following species are not known to occur in the Northwest Forest Plan area:

<i>Cantharellus cibarius</i>	<i>Clavariadelphus lovejoyae</i>	<i>Gastrosuillus amaranthii</i>
<i>Martellia monticola</i> .		

Efforts have been made to gather additional information about all species of fungi included under the Survey and Manage Standards and Guidelines. These efforts include literature reviews, searches of herbaria to gather distribution information, Table C-3 of the Northwest Forest Plan ROD, and Appendix J2 of the Northwest Forest Plan Final SEIS. For species included under Categories 1 and 2 in Table C-3 of the Northwest Forest Plan ROD, this information was summarized as of December 1996 in the Management Recommendations for Fungi (Castellano and O'Dell 1997). Additional information has come from research projects by mycologists in the Northwest Forest Plan area. These efforts have resulted in proposals to change the status of some species. For 16 species of fungi, new information is available regarding rarity, distribution, or association with late-successional or old-growth forest habitat, which greatly reduces concern



about risks to their range, distribution, and abundance. These species are discussed below. However, there is no new information that alters the assumptions or conclusions of the Northwest Forest Plan Final SEIS regarding risks to range, distribution, and abundance for the remaining species.

Table F-1 (in Appendix F) summarizes the number of records/sites of fungi located for two periods of time: the period prior to 1994 (which was prior to the Northwest Forest Plan ROD) and for the period 1994 and later. See Table 2-2 for a comparison of categories by alternative. See Table 2-4 for an explanation of why certain species are being removed from the Survey and Manage, Protection Buffer, and Protect from Grazing Standards and Guidelines. Table 3&4-2, at the end of this chapter, documents the disposition, by alternative, for the Protection Buffer species that remain under Survey and Manage.

Data for Survey and Manage fungi species resides in two databases, the Interagency Species Management System (ISMS) and the “O’Dell” database (at the Corvallis Forestry Sciences Laboratory, Pacific Northwest Research Station). All records in the O’Dell database refer to dried collections of the species that have been verified by taxa specialists and reside in an herbarium. All records in the O’Dell database were added to ISMS as of November 1999. Some data has been added to the O’Dell database since that time, particularly historic data from recent herbarium searches. Additional records in ISMS were received from various field units of the Agencies’, which may or may not have associated collections in an herbarium or verification by a specialist. The discussion of numbers of sites in the effects analysis section below is based on the O’Dell database, which has slightly more complete species coverage. The data displayed in Table F-1 refers to the ISMS database and may have slightly higher numbers for some species than the O’Dell database; in a few cases the numbers in ISMS are lower because some historic data has not yet been added. The differences in data quality and numbers of records are not of a magnitude to alter conclusions regarding risks to these species.

## Summary of Effects

The status of most fungi is either unchanged, or changed to provide slightly increased management under Alternatives 1, 2, and 3 compared to the No-Action Alternative. All but two fungi are in Category 3 in the No-Action Alternative. Category 3 requires extensive surveys to find high-priority sites for species management. Almost two-thirds of these fungi species are also in Category 1 in the No-Action Alternative which requires management of known sites. Similarly, most fungi are in Category 1A, 2B, or 3A in the action alternatives which require management of all known sites and strategic surveys. Alternatives 1 and 2 have a slight increase in management because all known sites are managed, instead of managing only high-priority sites in the No-Action Alternative. Alternative 3 also has the advantage of managing all known sites with a 250-meter buffer and conducting equivalent-effort pre-disturbance surveys. Additionally, under the No-Action Alternative, six species of fungi are also managed as Protection Buffer species which requires pre-disturbance surveys, management of high-priority sites, and extensive surveys. One species, *Bridgeoporus nobilissimus* (*Oxyporous nobilissimus*), is allocated “management areas of all useable habitat up to 600 acres.”

Many species of fungi included in the Survey and Manage Standards and Guidelines are so rare that some risk to stability will occur regardless of the alternative selected. Populations with low numbers of individuals are inherently unstable. Species with few populations and limited distributions are also inherently unstable. Low numbers and limited distributions may be: (1) the natural condition of the species; (2) a result of loss of historic habitat, populations, and individuals; or, (3) an artifact of incomplete knowledge of the species. The primary risks to stability of very rare species are habitat-altering disturbances sufficient to eliminate individuals or populations. Such disturbances include catastrophic wildfire, climate change, some management actions on private, state, or federally managed lands, and some agency management actions. These habitat-altering disturbances are the same across all alternatives and are largely outside the influence of the Agencies.

There continues to be a high degree of uncertainty regarding the expected future condition of many of the fungal species due to their rarity within the Northwest Forest Plan area. Some species, such as *Cortinarius speciosissimus* (shown in the Northwest Forest Plan ROD as *C. rainierensis*), have not been collected in the Northwest Forest Plan area for more than 40 years despite concerted efforts to locate them (Ammirati et al. 1994) and may be extirpated within the Northwest Forest Plan area. Twelve other species of fungi included under the Survey and Manage Standards and Guidelines have not been observed in the last 30 years. All 13 of these species are probably extirpated in the Northwest Forest Plan area. Others are known from so few sites that they are highly vulnerable to random disturbance events such as catastrophic wildfire. Ninety-six species are known from five or fewer sites within the last 30 years and there is considerable uncertainty if any alternative would meet species persistence objectives. Sixty-one species of fungi are known from between 6 and 20 sites within the past 30 years and there are similar concerns for stability. These concerns for stability cross all alternatives and are based primarily on the rarity of the species and not on management prescribed or denied by the alternatives. While there is some uncertainty due to incomplete understanding of species abundances and distributions, it does not seem possible to design an alternative consistent with the purpose and need for this SEIS that could eliminate much or all risk to the abundance and distribution of these species.

Under Alternative 1, 196 species of fungi would receive similar management or slightly greater protection compared to the No-Action Alternative. Similarly, there would be 202 species under Alternative 2 and 209 species under Alternative 3 that would receive similar or slightly greater protection. Compared to the No-Action Alternative, Alternative 1 increases known site management for 69 species while decreasing known site management for 2 species and removing pre-disturbance surveys for 7 species, including the rare Protection Buffer species, *Otidea leporina*, *O. smithii*, and *Sowerbyella rhenana*. Under Alternative 2, known site management is increased for 73 species and reduced for 5 species while pre-disturbance surveys are removed for 7 species. Under Alternative 3, known site management is increased for 74 species, equivalent-effort pre-disturbance surveys are added for 197 species, and pre-disturbance surveys are removed for 2 species. Species for which protection is decreased in the action alternatives compared to the No-Action Alternative include those being removed from the Survey and Manage mitigation measure (see Tables 2-4 and 2-5) and Protection Buffer species that would no longer receive pre-disturbance surveys (see Table 2-6).

Under the action alternatives, 16 species are removed from the Survey and Manage Standards and Guidelines because they do not meet the basic criteria for Survey and Manage or they are synonyms of other species (See Table 2-2). *Clavariadelphus lovejoyae*, *Cantharellus cibarius* (as shown in FEMAT), and *Martellia monticola* do not occur in the Northwest Forest Plan area and the alternatives would have no effect on these species. Six species, *Clavariadelphus borealis*, *Clavicornia avellanea*, *Clavulina cinerea*, *Elaphomyces* sp. nov. #Trappe 1038, *Phaeocollybia carmanahensis*, and *Rhizopogon* sp. nov. #Trappe 1692, #Trappe 1698, have been found to be synonyms of other species. The alternatives would have no effect on these species.

The reserve system and other standards and guidelines provide for a reasonable assurance of persistence for six species: *Cantharellus formosus*, *Clavulina cristata*, *Helvella compressa*, *Hydnum repandum*, *Omphalina ericetorum*, and *Thaxterogaster pingue*. All alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distributions; however, the latter two with a moderate level of uncertainty. Finally, *Bryoglossum gracile* is proposed for removal from Survey and Manage because it is not closely associated with late-successional or old-growth forest. While there is a high level of uncertainty, due to species rarity and lack of knowledge or unpredictable stochastic event, all alternatives would provide inadequate habitat (including known sites) to maintain the species. It is being considered for inclusion in the Agencies' special status species programs.

Under the action alternatives, two species, *Gomphus floccosus* and *Sarcosoma mexicanum*, are removed from the Survey and Manage Standards and Guidelines in part of their range because they do not meet the basic criteria for Survey and Manage in those areas. In that part of their

ranges where the two species are proposed for removal from Survey and Manage, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distribution. For *Gomphus floccosus* in California (where it remains under Survey and Manage), while there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution. For *Sarcosoma mexicanum* in Washington, California and Curry and Josephine Counties in Oregon (where this species remains under Survey and Manage), while there is a moderate level of uncertainty, all alternatives would provide inadequate habitat (including known sites) to maintain this species.

All alternatives would provide sufficient habitat (including known sites) to allow 29 species of fungi to stabilize in a pattern similar to their reference distributions, 28 with a moderate level of uncertainty and 1 with a high level of uncertainty. While there is a moderate level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow five species of fungi to stabilize in a pattern different from their reference distributions.

One hundred and sixty-four (164) species are so rare that there is inadequate habitat (including known sites) to maintain the species under any alternative; 13 with a low level of uncertainty, 139 with a moderate level of uncertainty, and 12 with a high level of uncertainty. Concerns for stability of these species is a function of their rarity and possibly loss of historic habitat and not related to the design or possible implementation of the alternatives. Finally, for 11 species, there is insufficient information to determine how any alternative would affect distribution and stability. However, known sites are managed for these species, strategic surveys will be conducted, and, if pre-disturbance surveys are practical, they will be conducted prior to habitat-disturbing activities.

All species that are included in the Survey and Manage Standards and Guidelines under the action alternatives would benefit from strategic surveys and management of known sites. Under the No-Action Alternative, most of these species would receive comparable benefits from extensive and general surveys and managing high-priority sites. Alternative 3 includes the additional effect of equivalent-effort, pre-disturbance surveys for some species. Alternative 3 would further reduce the risk to some very rare species by locating (through equivalent-effort surveys) and protecting more populations. However, it is not possible to predict in advance which species will benefit and to what extent. With such limited numbers and distributions of populations, any additional protected population might contribute substantially to species meeting persistence objectives. More of the populations of these species are likely to be stable under the action alternatives, particularly Alternative 3, than the No-Action Alternative.

## Environmental Consequences and Comparison of Alternatives

### Species That Would Remain Under Survey and Manage Standards and Guidelines Under All Alternatives

While there is a moderate level of uncertainty due to a lack of knowledge of species population biology, all alternatives would provide sufficient habitat (including known sites) to allow the following species to stabilize in a pattern similar to their reference distributions:

<i>Albatrellus flettii</i>	<i>Bondarzewia mesenterica</i>	<i>Cantharellus subalbidus</i>
<i>Clavariadelphus occidentalis</i>	<i>Clavariadelphus truncatus</i>	<i>Craterellus tubaeformis</i>
<i>Galerina vittaeformis</i>	<i>Gastroboletus subalpinus</i>	<i>Gastroboletus turbinatus</i>
<i>Gyromitra esculenta</i>	<i>Gyromitra infula</i>	<i>Gyromitra montana</i>
<i>Hydnum umbilicatum</i>	<i>Martellia maculata</i>	<i>Neolentinus kauffmanii</i>
<i>Neourmula pouchetii</i>	<i>Nivatogastrium nubigenum</i>	<i>Omphalina ericetorum</i>
<i>Phaeocollybia attenuata</i>	<i>Phaeocollybia fallax</i>	<i>Phaeocollybia kauffmanii</i>
<i>Phaeocollybia olivacea</i>	<i>Pithya vulgaris</i>	<i>Plectania melastoma</i>
<i>Ramaria rubripermanens</i>	<i>Sarcodon imbricatus</i>	<i>Sarcosphaera eximia</i>
<i>Thaxterogaster pingue</i>	<i>Tylophilus porphyrosporus</i>	

While there is a moderate level of uncertainty due to a lack of knowledge of species population biology, all alternatives would provide habitat (including known sites) sufficient to allow these species to stabilize in a pattern different from their reference distributions:

*Chalciporus piperatus*                      *Chromosera cyanophylla*      *Gomphus clavatus*  
*Tremiscus helvelloides*.

While there is a high level of uncertainty due to a lack of knowledge of species population biology and the difficulty of reliably identifying the species, all alternatives would provide sufficient habitat (including known sites) to allow *Gomphus bonarii* to stabilize in a pattern similar to its reference distribution.

While there is a moderate level of uncertainty due to a lack of knowledge of species population biology and the difficulty of reliably identifying the species, all alternatives provide sufficient habitat (including known sites) to allow *Gomphus kauffmanii* to stabilize in a pattern different from its reference distribution.

The following species have not been observed in the Northwest Forest Plan area in 30 years or more. These species are potentially extirpated within the Northwest Forest Plan area. Based on currently available information, all alternatives would provide inadequate habitat (including known sites) to maintain these species:

*Cortinarius speciosissimus*                      *Endogone oregonensis*                      *Gastroboletus imbellus*  
*Gymnomyces nondistincta*                      *Hydnotrya subnix*                      *Martellia idahoensis*  
*Octavianina macrospora*                      *Octavianina papyracea*                      *Ramaria concolor f. marrii*  
*Ramaria concolor f. tsugina*                      *Ramaria conjunctipes* var. *sparsiramosa*  
*Ramaria lorithamnus*                      *Ramaria suecica*.

While there is a moderate level of uncertainty due to the rarity of the species and the lack of knowledge of species population biology and the unpredictable nature of disturbance events, all alternatives would provide inadequate habitat (including known sites) to maintain these species:

<i>Acanthophysium farlowii</i>	<i>Albatrellus avellaneus</i>	<i>Albatrellus caeruleoporus</i>
<i>Albatrellus ellisii</i>	<i>Alpova alexsmithii</i>	<i>Alpova olivaceotinctus</i>
<i>Arcangeliella camphoratus</i>	<i>Arcangeliella crassa</i>	<i>Arcangeliella lactarioides</i>
<i>Asterophora lycoperdoides</i>	<i>Asterophora parasitica</i>	<i>Balsamia nigrens</i>
<i>Boletus haematinus</i>	<i>Boletus pulcherrimus</i>	<i>Bridgeoporus nobilissimus</i>
<i>Catathelasma ventricosa</i>	<i>Chamonixia caespitosa</i>	<i>Choiromyces alveolatus</i>
<i>Choiromyces venosus</i>	<i>Chroogomphus loculatus</i>	<i>Clavariadelphus ligula</i>
<i>Clavariadelphus sachalinensis</i>	<i>Clavariadelphus subfastigiatus</i>	
<i>Clavicornia piperata</i>	<i>Clavulina castanopes</i> v. <i>lignicola</i>	
<i>Clitocybe senilis</i>	<i>Collybia bakerensis</i>	<i>Cordyceps capitata</i>
<i>Cordyceps ophioglossoides</i>	<i>Cortinarius cyanites</i>	<i>Cortinarius magnivelatus</i>
<i>Cortinarius olympianus</i>	<i>Cortinarius valgis</i>	<i>Cortinarius variipes</i>
<i>Cortinarius verrucisporus</i>	<i>Cortinarius wiebeae</i>	<i>Cudonia monticola</i>
<i>Cyphellostereum laeve</i>	<i>Dermocybe humboldtensis</i>	<i>Destuntzia fusca</i>
<i>Destuntzia rubra</i>	<i>Dichostereum boreale</i>	<i>Elaphomyces anthracinus</i>
<i>Elaphomyces subviscidus</i>	<i>Endogone acrogena</i>	<i>Entoloma nitidum</i>
<i>Fevansia aurantiaca</i>	<i>Galerina atkinsoniana</i>	<i>Gastroboletus ruber</i>
<i>Gastroboletus vividus</i>	<i>Gastrosuillus umbrinus</i>	<i>Gautieria magnicellaris</i>
<i>Gautieria otthii</i>	<i>Gelatinodiscus flavidus</i>	<i>Glomus radiatus</i>
<i>Gymnomyces abietis</i>	<i>Gyromitra californica</i>	<i>Gyromitra melaleucoides</i>
<i>Hebeloma olympianum</i>	<i>Helvella crassitunicata</i>	<i>Helvella elastica</i>
<i>Helvella maculata</i>	<i>Hydnotrya inordinata</i>	<i>Hydropus marginellus</i>
<i>Hygrophorus caeruleus</i>	<i>Hygrophorus vernalis</i>	<i>Hypomyces luteovirens</i>
<i>Leucogaster citrinus</i>	<i>Leucogaster microsporus</i>	<i>Macowanites chlorinosmus</i>
<i>Macowanites lymanensis</i>	<i>Macowanites mollis</i>	<i>Marasmius applanatipes</i>

<i>Martellia fragrans</i>	<i>Mycena hudsoniana</i>	<i>Mycena monticola</i>
<i>Mycena overholtsii</i>	<i>Mythicomycetes corneipes</i>	<i>Neolentinus adhaerens</i>
<i>Octavianina cyanescens</i>	<i>Otidea leporina</i>	<i>Otidea smithii</i>
<i>Phaeocollybia californica</i>	<i>Phaeocollybia dissiliens</i>	<i>Phaeocollybia gregaria</i>
<i>Phaeocollybia oregonensis</i>	<i>Phaeocollybia piceae</i>	<i>Phaeocollybia pseudofestiva</i>
<i>Phaeocollybia sipei</i>	<i>Phaeocollybia spadicea</i>	<i>Phellodon atratus</i>
<i>Pholiota albivelata</i>	<i>Plectania milleri</i>	<i>Polyozellus multiplex</i>
<i>Pseudaleuria quinaultiana</i>	<i>Ramaria abietina</i>	<i>Ramaria amyloidea</i>
<i>Ramaria araiospora</i>	<i>Ramaria aurantiisiccescens</i>	<i>Ramaria celerivirescens</i>
<i>Ramaria claviramulata</i>	<i>Ramaria coulterae</i>	<i>Ramaria cyaneigranosa</i>
<i>Ramaria gelatiniaurantia</i>	<i>Ramaria gracilis</i>	<i>Ramaria hilaris</i> var. <i>olympiana</i>
<i>Ramaria largentii</i>	<i>Ramaria maculatipes</i>	<i>Ramaria rainierensis</i>
<i>Ramaria rubella</i> var. <i>blanda</i>	<i>Ramaria rubribrunnescens</i>	<i>Ramaria rubrievanescens</i>
<i>Ramaria spinulosa</i> var. <i>diminutiva</i>	<i>Ramaria stuntzii</i>	
<i>Ramaria thiersii</i>	<i>Ramaria verlotensis</i>	<i>Rhizopogon abietis</i>
<i>Rhizopogon brunneiniger</i>	<i>Rhizopogon chamaleontinus</i>	<i>Rhizopogon ellipsosporus</i>
<i>Rhizopogon evadens</i> var. <i>subalpinus</i>	<i>Rhizopogon exiguus</i>	<i>Rhizopogon flavofibrillosus</i>
<i>Rhizopogon inquinatus</i>	<i>Rhodocybe speciosa</i>	<i>Rickenella swartzii</i> <i>Russula</i>
<i>mustelina</i>	<i>Sarcodon fuscoindicus</i>	<i>Sarcosoma latahense</i>
<i>Sedecula pulvinata</i>	<i>Sowerbyella rhenana</i>	<i>Spathularia flavida</i>
<i>Stagnicola perplexa</i>	<i>Thaxterogaster pavelekii</i>	<i>Tricholoma venenatum</i>
<i>Tricholomopsis fulvescens</i>	<i>Tuber asa</i>	<i>Tuber pacificum</i> .

While there is moderate uncertainty due to a lack of specific population biology knowledge, based on currently available information, the above species are unlikely to have stable populations under any alternative, largely due to the very low numbers of occurrences. Compared to the No-Action Alternative, Alternatives 1 and 2 reduce concerns to rare species by requiring management of all known sites and strategic surveys to find additional sites. Alternative 3 may further reduce threats to stable populations of the very rare species, by locating, through equivalent-effort surveys, and managing more populations. Given the apparent rarity of these species, and the proportion of potential habitat in the Matrix land allocation, it is uncertain how many additional populations would be protected by these efforts. On the other hand, with such limited numbers and distributions of populations, any additional protected population might contribute substantially to the stability of one or more of these species. The lack of data regarding habitat requirements, population biology, and actual abundance and distribution of these species leads to uncertainty regarding long-term population stability. All of the action alternatives may help reduce the uncertainty through strategic surveys or through extensive surveys under the No-Action Alternative.

While there is a high level of uncertainty due to species rarity, lack of knowledge of species population biology, relatively low historic collecting efforts for the species, the difficulty of reliably identifying the species, and the unpredictable nature of disturbance events, all alternatives would provide inadequate habitat (including known sites) to maintain the following species:

<i>Baeospora myriadophylla</i>	<i>Bryoglossum gracile</i>	<i>Chrysomphalina grossula</i>
<i>Clitocybe subditopoda</i>	<i>Collybia racemosa</i>	<i>Cortinarius boulderensis</i>
<i>Cortinarius umidicola</i>	<i>Fayodia bisphaerigera</i>	<i>Mycena quinaultensis</i>
<i>Mycena tenax</i>	<i>Podostroma alutaceum</i>	<i>Sparassis crispa</i> .
<i>Ramaria botryis</i> var. <i>aurantiiramosa</i>		

While there is high uncertainty due to a lack of specific population biology knowledge, relatively low collecting efforts for the species, and the difficulty of reliably identifying the species, the above species are unlikely to have stable populations under any alternative, largely due to the low numbers of occurrences. Compared to the No-Action Alternative, Alternatives 1 and 2 reduce concerns to rare species by requiring management of all known sites and strategic surveys to find additional sites. Alternative 3 may further reduce threats to stable populations of the very rare

species, by locating, through equivalent-effort surveys, and protecting more populations. Given the apparent rarity of these species, and the proportion of potential habitat in the Matrix land allocation, it is uncertain how many additional populations would be protected by these efforts. On the other hand, with such limited numbers and distributions of populations, any additional protected population might contribute substantially to stability of one or more of these species. The lack of data regarding habitat requirements, population biology, and actual abundance and distribution of these species leads to uncertainty regarding long-term population stability. All of the action alternatives may help reduce the uncertainty through strategic surveys or through extensive surveys under the No-Action Alternative.

*Bridgeoporus nobilissimus* is currently known from about nine sites, but concerted efforts in appropriate habitat are finding few new sites. Because this species forms large, perennial sporocarps, the low number of new sites is not due to annual or seasonal variability in its fruiting. While there is a moderate level of uncertainty due to lack of knowledge of species population biology and the unpredictable nature of disturbance events, all alternatives would provide inadequate habitat (including known sites) to maintain *Bridgeoporus nobilissimus*.

Under the No-Action Alternative, *Bridgeoporus nobilissimus* is a Strategy 2 species and in Categories 1A, 2A, and 3A under the action alternatives. All alternatives, including the No-Action Alternative, require pre-disturbance surveys and 600-acre management areas. Most of the potential habitat for the species (forest stands with large diameter stumps, snags, or live *Abies procera*) is already in reserve allocations. While there is some uncertainty due to incomplete understanding of the species abundance and distribution, based on current information, it does not seem possible to design an alternative consistent with the purpose and need of this SEIS that could eliminate much or all risk to the long-term population stability of this species.

#### **Species Not Known From, But Suspected to Occur Within, the Northwest Forest Plan Area**

*Gastrosuillus amaranthii* has not been found, but is suspected to occur, within the Northwest Forest Plan area. This species is known only from California, in Lassen Volcanic National Park, near the southern boundary of the Northwest Forest Plan area. While no sites are currently documented from the Northwest Forest Plan area, it could occur here and meets the criteria for inclusion under the Survey and Manage Standards and Guidelines. The change in status from Categories 1 and 3 under the No-Action Alternative to Category 1E under Alternative 1 and Category 2C under Alternative 2 both require management of all known sites and so provide greater levels of protection than Categories 1 and 3 under the No-Action Alternative, where only high-priority sites must be managed. Category 3A under Alternative 3 provides additional protection by requiring equivalent-effort surveys, potentially allowing more populations to be found and managed.

Until *Gastrosuillus amaranthii* is found, there is no clear risk to the species' distribution and abundance from any action within the planning area. While there is considerable uncertainty based on currently available information, *Gastrosuillus amaranthii* will not have stable populations under any alternative. Compared to the No-Action Alternative, Alternatives 1 and 2 reduce concerns to this species by requiring management of all known sites and strategic surveys to find additional sites. Alternative 3 may further reduce the risk to the long-term population stability of this rare species, by locating, through equivalent-effort surveys, and managing more populations. Given the apparent rarity of the species, and the moderate proportion of potential habitat in the Matrix allocation, it is uncertain how many additional populations would be protected by these efforts. With such limited numbers and distributions of populations, any additional protected population might contribute substantially to species long-term population stability. While there is some uncertainty due to incomplete understanding of species abundance and distribution, based on current information, it does not seem possible to design an alternative consistent with the purpose and need of this SEIS that could eliminate much or all risk to the long-term population stability of this species.

### Species about which Little is Known

There is insufficient information regarding the following species to determine how any alternative would affect distribution and stability:

<i>Cortinarius barlowensis</i>	<i>Cortinarius depauperatus</i>	<i>Cortinarius tabularis</i>
<i>Galerina cerina</i>	<i>Galerina heterocystis</i>	<i>Galerina sphagnicola</i>
<i>Hygrophorus karstenii</i>	<i>Phaeocollybia scatesiae</i>	<i>Rhizopogon atroviolaceus</i>
<i>Rhizopogon truncatus</i>		

### Species Included as No-Action Alternative Category 2 and Protection Buffer Species

The following discussion applies to *Bondarzewia mesenterica*, a Category 2 species under the No-Action Alternative and the following Protection Buffer species: *Otidea leporina*, *O. onotica*, *O. smithii*, *Polyozellus multiplex*, and *Sowerbyella rhenana*, throughout the Northwest Forest Plan area, and *Sarcosoma mexicanum* in California, Washington, and Curry and Josephine Counties, Oregon.

The Survey and Manage Category 2 and Protection Buffer mitigation measure in the No-Action Alternative require surveys prior to ground-disturbing activities (USDA, USDI 1994b, p. C-5 and C-19). The Protection Buffer Standards and Guidelines further specify that survey protocols will have a high probability of detecting occupied sites (USDA, USDI 1994b, p. C-19). For fungi with sporocarps that are short lived and annually variable, the goal of high probability of detecting occupied sites requires 5 or more years of repeated surveying, and is not practical to attain.

Under the No-Action Alternative, all of these species require pre-disturbance surveys, management of known sites, and extensive surveys (to locate high-priority sites for management). Although some of these species are assigned to different categories under the action alternatives, all of the species would receive identical management under any particular alternative (Tables 2-2 and 2-4).

Under Alternative 1 (Categories 1B and 1E) and Alternative 2 (Categories 2B and 2C), these seven species would receive management of all known sites and strategic surveys. The principle difference from the No-Action Alternative is that Alternatives 1 and 2 eliminate the requirement for pre-disturbance surveys. Because the pre-disturbance survey requirement is eliminated, protection for these species is reduced. Without pre-disturbance surveys, some sites for these species may be lost due to management activities. However, with strategic surveys, more of the potential habitat for the species may be scrutinized than with pre-disturbance surveys because strategic surveys may be prioritized in high-probability habitat for the species, and sites can be located and additional information gained efficiently. Therefore, threats to the range, distribution, and abundance of these species under Alternatives 1 and 2 are slightly greater than under the No-Action Alternative. While there is a moderate level of uncertainty due to species rarity and lack of knowledge of species population biology and the unpredictable nature of disturbance events, all alternatives would provide inadequate habitat (including known sites) to maintain *Otidea smithii*, *Sowerbyella rhenana*, *Otidea leporina*, and *Polyozellus multiplex*, throughout the Northwest Forest Plan area, and *Sarcosoma mexicanum* in California, Washington, and Curry and Josephine Counties, Oregon. While there is a moderate level of uncertainty due to a lack of knowledge of species population biology, all alternatives would provide sufficient habitat (including known sites) to allow *Bondarzewia mesenterica* and *Otidea onotica* to stabilize in a pattern similar to their reference distributions.

Under Alternatives 1 and 2, habitat-disturbing activities would not be initiated in old-growth forests in fiscal year 2011 and beyond, unless strategic surveys for fungi have been completed for the province. During this 10-year period, inadvertent loss of sites could occur through habitat-disturbing activities because pre-disturbance surveys would not be required. This inadvertent loss of sites could continue into the future as strategic surveys are not intended to replace pre-disturbance surveys. The degree of risk to the species would be related to the amount and

distribution of habitat disturbed through such activities. Currently, approximately 8 million acres of late-successional forest exist in the Northwest Forest Plan area. It is estimated during this 10-year period that approximately 2.5 to 4 percent of the total late-successional forest in the Northwest Forest Plan area will be modified through partial cut harvest, regeneration harvest, or prescribed fire in the Matrix and Adaptive Management Area land allocations. This level of disturbance represents approximately 20 to 30 percent of the late-successional forest located in Matrix and Adaptive Management Area land allocations (Cadwell and Denton 1999). The distribution of these habitat-disturbing activities is expected to be relatively uniform across, and occur mostly in, the late-successional or old-growth forest in the Matrix and Adaptive Management Areas. This 10-year period of potential habitat-disturbing activities prior to completion of strategic surveys could have an effect on the ability of these species to be maintained on federally managed lands because of the amount of habitat loss and potential loss of sites. In those parts of the region with low amounts of late-successional and old-growth forest habitat, such habitat could be critical to maintaining some of these species, particularly *Otidea smithii* and *Sowerbyella rhenana*, in a stable condition.

Under Alternative 3, these species would receive management of all known sites with a 250-meter buffer, equivalent-effort surveys, and strategic surveys. Fungal individuals range in size from a few centimeters across to many acres (Dahlberg and Stenlid 1990 and Smith et al. 1992). For most species, including all of these, the average size of individuals is unknown. So, the effect of a 250-meter buffer cannot be assessed with confidence. However, if such a buffer reduces the change in microclimate compared to current mitigation, it would then increase the chances of a population continuing to persist at those sites. The principle difference compared to the No-Action Alternative is changing the requirement for a high probability of detecting occupied sites which might require 5 years or more, to equivalent-effort surveys limited to two field seasons. However, some occupied sites would not be detected in the two field seasons allotted for survey under this option. Therefore, Alternative 3 would slightly increase concerns to these species, compared to the No-Action Alternative. Compared to Alternatives 1 and 2, Alternative 3 would reduce concerns to the species range, distribution, and abundance because it adds a pre-disturbance (equivalent-effort) survey requirement.

## **Species That Would Be Removed From the Survey and Manage Standards and Guidelines Under the Action Alternatives**

### **Species Not Known or Suspected to Occur in the Northwest Forest Plan Area**

The following three species are proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives because the species do not occur within the Northwest Forest Plan area.

*Clavariadelphus lovejoyae* is only known to occur in Wyoming (Methven 1990). *Martellia monticola* is only known to occur in Idaho and California (Castellano and O'Dell 1997). Because *Clavariadelphus lovejoyae* and *Martellia monticola* do not occur in the Northwest Forest Plan area, they are not affected by any alternatives. *Clavariadelphus lovejoyae* and *Martellia monticola* do not meet the criterion that “the species must occur within the Northwest Forest Plan area, or occur close to the Northwest Forest Plan area and have potentially suitable habitat within the Northwest Forest Plan area.”

*Cantharellus cibarius*, as considered by the FEMAT panel, does not occur in the Northwest Forest Plan area. Since 1994, it has been determined that *Cantharellus formosus*, not *C. cibarius*, is the common yellow chanterelle in the Northwest Forest Plan area (Redhead et al. 1997). Because *Cantharellus cibarius* does not occur in the Northwest Forest Plan area, it is not affected by any alternatives. *Cantharellus cibarius* does not meet the criterion that “the species must occur within the Northwest Forest Plan area, or occur close to the Northwest Forest Plan area and have potentially suitable habitat within the Northwest Forest Plan area.”



### Species Not Associated With Late-Successional or Old-Growth Habitat

The following four species are proposed for removal from the Survey and Manage Standards and Guidelines because they do not meet the basic criteria that the species must be closely associated with late-successional or old-growth forest.

*Bryoglossum gracile* is associated with mosses in subalpine meadows and boulder fields. It is not a forest species (Castellano and O'Dell 1997). Therefore, *B. gracile* does not meet the basic criteria that "The species must be closely associated with late-successional or old-growth forest" and "The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence." Management activities are limited in such habitats and much of this extensively distributed habitat is in reserve (Congressionally or Administratively Withdrawn) land allocations. *Bryoglossum gracile* is only known from about three sites, two of which are historic, so it is vulnerable to disturbance; most potential habitat for the species have not been surveyed. It is likely that additional populations would be located with a modest amount of effort. *Bryoglossum gracile* is being considered for inclusion in the Agencies' special status species programs. While there is a high level of uncertainty due to lack of knowledge, no alternative would provide habitat to maintain the species.

*Cantharellus formosus* is most abundant in younger forest types. A recent study found that it is 10 times more likely to be found in 40-year-old stands than in adjacent 400+ year-old stands (Dunham, O'Dell, and Molina, unpublished data). This species was so frequently encountered during surveys that it is rarely recorded. Even so, over 60 new occurrences are documented. It is also more abundant and broadly distributed across a wide range of habitats than thought at the time the Northwest Forest Plan was written (USDA, USDI Species Review Panel 1999b). Therefore, *Cantharellus formosus* does not meet the criterion for inclusion in the Survey and Manage Standards and Guidelines that the species must be closely associated with late-successional or old-growth forest. All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Clavulina cristata* has been found in more than 50 sites during recent surveys, mostly in habitats other than late-successional or old-growth forest. It is also known from hundreds of additional sites from herbarium records. New sites were found in all 10 of the 30- to 50-year old stands selected for a study of the association of Survey and Manage fungi to coarse woody debris (Cazares et al. unpub). The occurrence of this species at all 10, essentially randomly selected, sites demonstrates its high frequency. In fact, it is the most frequently encountered mushroom in this study of early-successional stands. This species is frequently collected in early-successional stands; it is not a late-successional or old-growth forest associated species and does not meet the criteria for Survey and Manage Standards and Guidelines under the Northwest Forest Plan (USDA, USDI Species Review Panel 1999b). All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Helvella compressa* occurs frequently in young stands, and has been collected from disturbed habitats such as suburban lawns and cultivated gardens (Castellano and O'Dell 1997). It is not associated with late-successional and old-growth forests, although it can occur in late-successional stands. It is no longer thought to be at risk because it is frequently encountered in early-successional and disturbed habitats and is broadly distributed across a wide range of habitats. There have been over 100 new occurrences of this species found since 1995 and these are mostly in habitats other than late-successional or old-growth forest. *Helvella compressa* does not meet the basic criterion for inclusion in the Survey and Manage Standards and Guidelines that the species must be closely associated with late-successional or old-growth forest. All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

### **Species That Are More Abundant and Broadly Distributed Than Thought When the Northwest Forest Plan Was Prepared**

The following seven species are proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives (*Gomphus floccosus* is only proposed for removal in Oregon and Washington, and *Sarcosoma mexicanum* is only proposed for removal in Oregon, except for Curry and Josephine Counties) because they are more widely distributed than originally thought. They do not meet the criterion for inclusion in the Survey and Manage Standards and Guidelines that “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.”

The following discussion of *Gomphus floccosus* applies only to the Oregon and Washington portions of its range in the Northwest Forest Plan area. *Gomphus floccosus* is now known to occur at more than 200 sites in the Northwest Forest Plan area, primarily in Oregon and Washington. Undoubtedly, many more sites could easily be found because this species has broad habitat requirements and extensive areas of potential habitat have not yet been surveyed. Because this species is frequently encountered, it does not have threats to its range, distribution, and abundance (USDA, USDI Species Review Panel 2000c). All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution throughout its range in the Oregon and Washington portions of the Northwest Forest Plan area.

*Hydnum repandum* is now known to occur at more than 90 sites that are distributed widespread but spotty throughout its range (northern Washington to northern California) in the Northwest Forest Plan area. Over 70 percent of these sites are in reserve land allocations. Undoubtedly, many more sites could easily be found because this species has broad habitat requirements and extensive areas of potential habitat have not yet been surveyed. The abundance of this species is further evidenced by the fact that it is a major commercially harvested species; Arora (1986) describes it as “sometimes outrageously abundant.” Apparently, commercial picking was considered the major concern to the species by the FEMAT panelists (pp. 175-176 in Appendix J2 of USDA, USDI 1994a). New information does not evidence a threat to this fungi from removing sporocarps (Egli et al. 1990 and Norvell 1995). Because this species is frequently encountered, it does not have threats to its range, distribution, and abundance (USDA, USDI Species Review Panel 1999b). All alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Martellia maculata* is the correct name for what was thought to be an undescribed species (*Elaphomyces* sp. nov. #Trappe 1038) (Castellano and O’Dell 1997). The reputed collection tentatively identified as a new species was only known from one site; however, *M. maculata* is known from approximately 30 sites, is distributed widespread but spotty throughout its range, and over 70 percent of known sites are in reserve land allocations. Furthermore, this species was not considered by the FEMAT panelists to have any risks to its range, abundance, and distribution, nor does any new information indicate that to be the case. Because it occurs in a wide range of habitats (coastal hemlock, Douglas-fir, and montane true fir forests) ranging from early to late successional, it does not have threats to its range, distribution, and abundance (USDA, USDI Species Review Panel 1999b). Therefore, *Martellia maculata* does not meet the criterion for inclusion in the Survey and Manage Standards and Guidelines that “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.” While there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Omphalina ericetorum* was not indicated to have risks to viability at the time of the Northwest Forest Plan Final SEIS. There have been over 100 sites discovered since then. These sites cover most of the Northwest Forest Plan area from northern Washington to northern California. Recent surveys have found over 30 sites in the past 3 years. *Omphalina ericetorum* is frequently encountered and broadly distributed across a wide range of habitats (from coastal to montane, many different forest types, plant associations, and successional stages). Therefore, *Omphalina*

*ericetorum* does not meet the criterion for inclusion in the Survey and Manage Standards and Guidelines that “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species.” The expected future condition for *Omphalina ericetorum* is numerous, stable populations. While there is a moderate level of uncertainty, all alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Rhizopogon parksii* is the correct name for what was thought to be an undescribed species (*Rhizopogon* sp. nov. #Trappe 1692 and 1698) (Castellano et al. 1999). The reputed collections tentatively identified as a new species were from two sites. *R. parksii* is known from over 200 sites across its range in the Northwest Forest Plan area and in a wide range of habitats (mesic to dry forest types with a Douglas-fir component) and successional stages. It does not have risks to its range, distribution, and abundance because it is frequently encountered and broadly distributed across a wide range of habitats. This species was not considered by the FEMAT panelists to have any risks to its range, abundance, and distribution, nor does any new information indicate that to be the case. Furthermore, this species is frequently collected in early-successional stands; it is not a late-successional or old-growth forest associated species. Therefore, *Rhizopogon parksii* does not meet the criteria for inclusion in the Survey and Manage mitigation that “The species must be closely associated with late-successional or old-growth forest” and “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.” All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

The following discussion of *Sarcosoma mexicanum* applies only to its range in Oregon outside of Curry and Josephine Counties. *Sarcosoma mexicanum* has been found on about 75 sites in the Oregon Coast Range and Willamette Valley Physiographic Provinces during the past 3 years over a wide range of habitat, mostly other than late-successional or old-growth forest. In the past, it was likely under reported because it typically fruits in winter and early spring when fungi are not usually being collected. Because this fungus is frequently encountered in a broad range of habitats, usually Douglas-fir forests lacking late-successional characteristics, there is no threat to its population in this portion of the range of the species (USDA, USDI Species Review Panel 1999b). Therefore, *Sarcosoma mexicanum* in Oregon outside of Curry and Josephine Counties, does not meet the criteria for inclusion in the Survey and Manage Standards and Guidelines that “The species must be closely associated with late-successional or old-growth forest” and “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.” All alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution in Oregon outside Curry and Josephine Counties.

*Thaxterogaster pingue* is locally abundant throughout its range and is known from more than 100 sites. Many new sites are being found across the Northwest Forest Plan area. Over 70 percent of the sites are in reserve land allocations. This species is frequently encountered because there are extensive areas of its preferred habitats (late-successional, high-elevation *Abies* dominated forests) in reserve allocations. It does not have threats to its range, distribution, and abundance (USDA, USDI Species Review Panel 1999b). *Thaxterogaster pingue* does not meet the criterion for inclusion in the Survey and Manage mitigation measure that “The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.” While there is a moderate level of uncertainty, all alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

### **Synonyms of Other Species on Table C-3 of the Northwest Forest Plan ROD**

The following species will be removed from the Survey and Manage Standards and Guidelines because they are duplicate names. They are addressed in more detail elsewhere in this effects analysis.

*Clavariadelphus borealis* is a taxonomic synonym of *C. truncatus* (Methven 1990). *Clavariadelphus truncatus* would receive equal or greater management under all action alternatives, compared to the No-Action Alternative.

*Clavulina cinerea* is a taxonomic synonym of *C. cristata*, a frequently encountered and broadly distributed species (Methven 1990). *Clavulina cristata* is proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives.

*Phaeocollybia carmanahensis* is a taxonomic synonym of *P. oregonensis* (Norvell 1998). *Phaeocollybia oregonensis* would receive equal or greater management under all action alternatives, compared to the No-Action Alternative.

### **Synonyms of Other Species NOT on Table C-3 of the Northwest Forest Plan ROD**

The following species will be removed from the Survey and Manage Standards and Guidelines because they are duplicate names. They are addressed in more detail elsewhere in this effects analysis.

*Clavicornia piperata* is a taxonomic synonym of *Clavicornia avellanea*, which passed the original FEMAT screens. While there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Elaphomyces* sp. nov. #Trappe 1038 was thought at the time of FEMAT to be an undescribed species. Further scrutiny revealed it to be *Martellia maculata*, a common species with no risk to stability. While there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Rhizopogon* sp. nov. #Trappe 1692, #Trappe 1698 was thought at the time of FEMAT to be an undescribed species. Further scrutiny revealed it to be *Rhizopogon parksii*, a common species with no risk to stability. All alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

## **Lichens**

### **General Background**

The Survey and Manage Standards and Guidelines were originally applied to 81 lichen species. Of these, 75 were included because they did not pass the screens of the additional species analysis in the Northwest Forest Plan Final SEIS and it was thought that additional mitigation was needed to provide for species persistence. An additional six species, not rated during the FEMAT viability panels because of insufficient information, were included in the Survey and Manage Standards and Guidelines. The reason for adding these six species was to manage known sites while acquiring information necessary to address concerns for their persistence.

Since 1994, new information has been acquired on the occurrence and distribution of the lichen species covered by Survey and Manage Standards and Guidelines. Information has been acquired from field surveys, herbaria, literature, field units, and taxonomic experts. This information was evaluated when determining the appropriate level of mitigation for the lichen species covered by these standards and guidelines and it was also used in developing the action alternatives. The historic distribution of these species is unknown in the Northwest Forest Plan area. Therefore, the geographic distribution and biological distribution (reference distribution) for these species are inferred from the available information on the current distribution and habitat associations within the species range.

The three action alternatives explicitly define three basic criteria necessary for a species to be included under the Survey and Manage Standards and Guidelines. These criteria were taken from the FEMAT and Northwest Forest Plan Final SEIS analyses and are repeated in Chapter 2.

## Summary of Effects

A brief summary of effects for lichens is provided here prior to the detailed discussion, due to the large number of species discussed and the length of this section. Under the action alternatives, 35 lichens would be removed and 49 lichens would remain under the Survey and Manage Standards and Guidelines. These numbers include the three species that are removed from Survey and Manage in only a portion of their ranges.

For 49 species (including the 3 split range species), all alternatives have similar management actions that vary in application by alternative: manage known sites, pre-disturbance surveys, and strategic surveys or extensive and general regional surveys. The provision for conducting strategic surveys under the action alternatives and extensive or general regional surveys under the No-Action Alternative would increase the efficiency and effectiveness of species management in the future by prioritizing and targeting surveys to address specific questions relative to management necessary for a species.

The three action alternatives have similar provisions for adaptive management to allow the Agencies to respond to changing information and to provide appropriate management for species. Adaptive management would result in more effective species management by assigning the species to the category that provides the appropriate level of management needed for species persistence objectives.

Compared to the No-Action Alternative, species receive different management under the action alternatives as a result of the application of new information and the slightly different emphasis of the alternatives. Under Alternative 1, pre-disturbance surveys are added for 8 lichens, management of known sites is increased for 22 lichens, and known site management is removed for 1 lichen. There is no change for the number of species receiving strategic surveys under Alternative 1 as compared to extensive or general regional surveys under the No-Action Alternative.

Under Alternative 2, 28 lichens receive increased known site management (for sites known as of September 30, 1999), pre-disturbance surveys are added for 8 lichens, and known site management is removed for 1 lichen. Under Alternative 3, 28 lichens receive increased known site management and pre-disturbance surveys are added for 38 lichens.

Of the 49 lichens remaining under Survey and Manage, four species were split for analytical purposes due to differences in anticipated effects in different parts of their ranges. This resulted in 53 separate determinations for these 49 species. All alternatives would provide sufficient habitat (including known sites) to allow 15 species to stabilize in a pattern similar to their reference distributions, with various levels of uncertainty. All alternatives would provide habitat (including known sites) sufficient to allow six species to stabilize in a pattern different from their reference distributions, with various levels of uncertainty.

All alternatives would provide inadequate habitat (including known sites) to maintain 12 species, with moderate to high levels of uncertainty. This is primarily due to lack of knowledge regarding these species and their rarity and/or limited habitat or known sites on federally managed land and is not related to the design or possible implementation of the alternatives. There is insufficient information regarding 20 species to determine how any alternative would affect distribution and stability. However, known sites are managed for these species, strategic surveys will be conducted, and, if pre-disturbance surveys are practical, they will be conducted prior to habitat-disturbing activities.

Thirty-five species would be removed from Survey and Manage and Protection Buffer Standards and Guidelines under the action alternatives, either in all (32 species) or portions (3 species) of their range, because they no longer meet the three basic criteria for inclusion under the Survey and Manage Standards and Guidelines. For the 35 lichens that are removed from the Survey and Manage Standards and Guidelines, 25 species, including the 3 split range species, are expected to maintain stable populations and be distributed in a pattern similar to their reference distributions on federally managed lands within the Northwest Forest Plan area, with varying levels of uncertainty. While there is a high level of uncertainty for three species, all alternatives would provide inadequate habitat (including known sites) to maintain the species. There is insufficient information regarding seven species to determine how any alternative would affect distribution and stability. Fourteen species of lichen (including the three with inadequate habitat and the seven with insufficient information) are being removed from Survey and Manage because they do not meet the criterion of being closely associated with late-successional or old-growth forest and are being considered for management under the Agencies' special status species programs.

## **Lichens Proposed for Removal From the Survey and Manage Standards and Guidelines under the Action Alternatives**

### ***Pilophorus nigricaulis* and *Sticta arctica***

#### **Background and Affected Environment**

*Pilophorus nigricaulis* and *Sticta arctica* are proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives because they do not meet the criterion for being closely associated with late-successional or old-growth forests. However, current information indicates these rock-dwelling species are rare within the Northwest Forest Plan area (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b).

*Sticta arctica* is known to occur in western North America from Alaska to northwestern Oregon, and in Siberia and Kamchatka. Known sites for *Sticta arctica* in the Northwest Forest Plan area have increased from one to two since 1993. The two sites are widely disjunct, and both are on nonfederal land (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). Therefore, the species is assumed to be extremely limited in the planning area. Habitat at the known sites is reported as rock ledges and mossy soil at a non-forest site near sea level in Puget Sound, and an open site on a moss-covered basalt outcrop on a rocky mountain summit (2,950 feet) in coastal northwestern Oregon. The population in Oregon is reported as very small (McCune et al. 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). Current information suggests that *Sticta arctica* has an extremely limited geographic range in the Northwest Forest Plan area, its distribution is limited to a small portion within this range, and it occurs in isolated sites.

*Pilophorus nigricaulis* is a rare rock lichen and is known to occur in western North America from Alaska to Oregon, and in Japan. The number of known sites for this species in the Northwest Forest Plan area has increased from 2 to 16 since 1993, with additional unreported sites likely (Appendix J2 in USDA, USDI 1994b and USDA, USDI Species Review Panel 1999b). Its distribution is limited throughout the Northwest Forest Plan area where it has been reported in the Cascade Mountains from northern Washington to central Oregon (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). The majority of the reported sites on federally managed land are in reserve land allocations (USDA, USDI Species Review Panel 1999b). *Pilophorus nigricaulis* is found primarily in non-forest communities in cool, moist sites on talus slopes, cliffs, rock outcrops, and large boulders (McCune and Geiser 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). Population size varies from small to locally abundant (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). Current information suggests that *Pilophorus nigricaulis* has a limited overall geographic range within the Northwest Forest Plan area, with a limited distribution in this area, and it occurs in isolated sites or isolated site clusters.

## Environmental Consequences and Comparison of Alternatives

There are concerns for *Sticta arctica* and *Pilophorus nigricaulis* because they have limited distributions and are known from few sites in the Northwest Forest Plan area. These species would receive greater protection under the No-Action Alternative compared to the action alternatives. *Sticta arctica* and *Pilophorus nigricaulis* are in Categories 1 and 3 in the No-Action Alternative where all current and future known sites would be managed and extensive surveys would be required. Neither of these actions would be required in the action alternatives. The two known sites for *Sticta arctica* are on nonfederal land, although additional sites could be discovered on federally managed land through future extensive survey efforts under the No-Action Alternative. Because all known sites of *Sticta arctica* are on nonfederal land, the requirement to manage known sites would not increase the likelihood that the species will maintain stable populations and be distributed in a pattern similar to or altered from its reference distribution on federally managed lands within the Northwest Forest Plan area.

In the three action alternatives, these two species would be removed from Survey and Manage because they do not meet the criterion of being closely associated with late-successional or old-growth forests. However, these species remain of concern because of their limited distribution and abundance. These species would not be managed under the Northwest Forest Plan because they are not late-successional or old-growth forest species; they are being evaluated for inclusion in the Agencies' special status species programs.

It is uncertain if the Survey and Manage Standards and Guidelines under any alternative provide for stable populations of *Sticta arctica* distributed in a pattern similar to or altered from its reference distribution on federally managed lands within the Northwest Forest Plan area. This is because *Sticta arctica* is known only from two sites, both on nonfederal land, and is potentially vulnerable to stochastic events due to its rarity. There is insufficient information regarding this species to determine how any alternative would affect its distribution and stability.

The No-Action Alternative provides a greater likelihood than the action alternatives of maintaining *Pilophorus nigricaulis* in stable populations distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area because of the requirement to manage known sites and to conduct extensive surveys to find additional sites. There is a moderate degree of uncertainty of this outcome under any of the action alternatives. However, inclusion in the special status species programs may provide a similar outcome as the No-Action Alternative for maintaining *Pilophorus nigricaulis*, although there is a low to moderate level of uncertainty under all alternatives because of the low number of sites and limited distribution of this species. *Pilophorus nigricaulis* typically occurs in non-forest communities where management activities may be less likely to occur.

***Calicium adaequatum, Chaenotheca brunneola, Cyphelium inquinans, Mycocalicium subtile, and Stenocybe major***

## Background and Affected Environment

Pin lichens were evaluated as a group of 16 species by the lichen panel for the FEMAT analysis. The pin lichens were rated as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to allow the species to maintain a stable, well-distributed population across federally managed lands within the Northwest Forest Plan area. This was because they were thought to be late-successional or old-growth forest associated species and little was known of their distribution, ecology, or abundance in the Pacific Northwest (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Information acquired since the FEMAT analysis (USDA, USDI Species Review Panel 1999b) indicates the above species are not closely associated with late-successional or old-growth forests. These five species of pin lichens are proposed for removal from the Survey and Manage Standards and Guidelines under the three action alternatives because they do not meet the three basic criteria of Survey and Manage.

*Calicium adaequatum*, *Chaenotheca brunneola*, *Cyphelium inquinans*, *Mycocalicium subtile*, and *Stenocybe major* have broad global distributions and occur on several continents (Tibell 1975). Most of these species have broad ecological amplitude and occur in a variety of habitats and stand ages (Tibell 1975 and USDA, USDI Species Review Panel 1999b), and are reported as common (USDA, USDI Species Review Panel 2000b). These lichens are very small, which presents survey difficulties (Appendix J2 in USDA, USDI 1994b). However, limited survey efforts by taxa experts in the federal agencies and universities have reported many new sites since 1993 (USDA, USDI Species Review Panel 1999b and 2000b).

*Calicium adaequatum*, a circumboreal (occurring at northern latitudes) species, is reported from eight locations in the Northwest Forest Plan area. There are three recent sites reported from federally managed land (Table F-2). The species occurs on both sides of the Cascades and on federally managed and nonfederal lands (USDA, USDI Species Review Panel 1999b). All known sites are from twigs and branches of young hardwoods such as oak, alder, ash, and apple. Reported habitat is oak forests, young to mature riparian forests, and apple orchards. Current information indicates this species is not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

*Chaenotheca brunneola*, *Cyphelium inquinans*, and *Mycocalicium subtile* are more common and widespread than originally thought (USDA et al. 1993; USDA, USDI Species Review Panel 1999b; and Appendix J2 in USDA, USDI 1994b). These species have broad global distributions. They occur in a wide range of habitats and stand ages. They are found on a variety of substrates including bark, wood, snags, and conifer and deciduous trees; some occur on lumber and fence posts (USDA, USDI Species Review Panel 1999b). Current information indicates these species are not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

Information on the distribution of these three species has greatly increased since 1993, despite limited survey effort. *Chaenotheca brunneola* occurs on both sides of the Cascades and the known sites have increased from 2 to 26; 21 are recent sites on federally managed land. *Cyphelium inquinans* occurs on both sides of the Cascades and the known sites have increased from 2 to 37; 29 are recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). *Mycocalicium subtile* was only suspected to occur in the Pacific Northwest in 1993, as regional herbaria searches did not encounter any collections for this species from the Northwest Forest Plan area dated prior to 1993 (USDA, USDI Species Review Panel 1999b). Now there are 10 known sites; 8 are recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). *Mycocalicium subtile* is also the most commonly encountered pin lichen in the north Maine woods (Selva 1988).

*Calicium adaequatum*, *Chaenotheca brunneola*, *Cyphelium inquinans*, and *Mycocalicium subtile* have similar distribution patterns. Current information suggests these species have a widespread geographic range, with a widespread but spotty distribution within their ranges in the Northwest Forest Plan area, and they are thought to occur in isolated site clusters.

*Stenocybe major* occurs in North America and Europe (Tibell 1975). Limited survey effort has increased the number of known sites for this species from two to six in the Northwest Forest Plan area since 1993, four of these sites are on federally managed land. *Stenocybe major* is reported from Oregon and Washington, but the relatively few records may be a function of limited surveys and the small size of this lichen. This species occurs on the bark of true firs (conifers in the *Abies* genus). The four recent collections are from young stands where the trees are less than 80 years old (USDA, USDI Species Review Panel 1999b). This species was observed on practically every specimen of cone-bearing age *Abies balsamea* in the north Maine woods (Selva 1988). Based on current information, this species does not appear to be closely associated with late-successional or old-growth forest (USDA, USDI Species Review Panel 1999b). Current information suggests that *Stenocybe major* has a moderate geographic range, with a limited distribution throughout the Northwest Forest Plan area, and it is thought to occur in isolated site clusters.



## Environmental Consequences and Comparison of Alternatives

These five species of pin lichens were poorly known at the time of the FEMAT assessment and additional species analysis for the Northwest Forest Plan Final SEIS (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Under the No-Action Alternative, these species are in Category 4, which requires general regional surveys to acquire additional information and determine the necessary levels of management.

In the action alternatives, these five pin lichens are proposed for removal from the Survey and Manage Standards and Guidelines. Current information indicates that *Calicium adaequatum*, *Chaenotheca brunneola*, *Cyphelium inquinans*, *Mycocalicium subtile*, and *Stenocybe major* are not closely associated with late-successional or old-growth forests. The number of known sites for these species has increased since 1993, despite limited survey effort. *Chaenotheca brunneola* and *Cyphelium inquinans* have widespread distributions and occur in a broad range of habitats, as does *Mycocalicium subtile* although it is known from fewer sites. The reserve land allocations and other standards and guidelines (such as green tree and snag retention, and 15 percent retention of late-successional forest in watersheds) would all contribute to providing for stable populations of *Chaenotheca brunneola*, *Cyphelium inquinans*, and *Mycocalicium subtile* distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. This outcome has a low level of uncertainty for *Chaenotheca brunneola* and *Cyphelium inquinans*, but a high level of uncertainty for *Mycocalicium subtile*, because of the low number of sites and limited information for this species.

*Calicium adaequatum* occurs on hardwood species and in riparian areas. There is insufficient information to determine how any alternative would affect this species distribution and stability.

*Stenocybe major* remains poorly known in the Northwest Forest Plan area, with only six reported sites. This species may not be rare in the Northwest Forest Plan area; the limited number of sites may be a function of limited surveys and the difficulty of surveying due to its very small size. Under the three action alternatives, this species is removed from Survey and Manage because it does not meet the criterion for close association with late-successional or old-growth forests. *Stenocybe major* is known to occur only on *Abies* (true firs), which are widespread in Pacific Northwest forests and could provide potential habitat for this species. Under the No-Action Alternative, there would be no management of known sites of this species, but the general regional surveys could address the lack of knowledge about the species rarity by acquiring additional information on species distribution, abundance, and habitat requirements.

*Mycocalicium subtile* and *Stenocybe major* are currently known from few sites in the Northwest Forest Plan area. These species would be removed from the Survey and Manage Standards and Guidelines under the action alternatives because they are not late-successional or old-growth forest associated species; however, they are being evaluated for inclusion in the Agencies' special status species programs. Management under the special status species program and the No-Action Alternative would increase the likelihood of maintaining stable populations of *Mycocalicium subtile* and *Stenocybe major* distributed in a pattern similar to their reference distributions on federally managed lands within the Northwest Forest Plan area until more information is acquired regarding their distribution and abundance. Currently there is insufficient information for *Stenocybe major* to determine how any alternative would affect its distribution and stability.

***Lobaria hallii*, *L. pulmonaria*, *L. scrobiculata*, *Nephroma helveticum*, *N. laevigatum*, *N. parile*, *N. resupinatum*, *Pannaria leucostictoides*, *P. mediterranea*, *Peltigera collina*, *P. neckeri*, *Pseudocyphellaria anomala*, *P. anthraxis*, *P. crocata*, *Sticta beauvoisii*, *S. fuliginosa*, and *S. limbata***

## Background and Affected Environment

Concerns were expressed in the FEMAT analysis for the above 17 nitrogen-fixing lichen species because of their sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI

1994b). They were of particular concern because nitrogen-fixing lichens are known to be among the most sensitive lichens to air pollution effects (Hawksworth and Hill 1984 in USDA et al. 1993). Therefore, a major concern for this group of species was not their rarity, but potential air pollution effects over the 100-year timeframe used in the assessment (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b).

*Lobaria hallii* is known to occur in North America, Scandinavia, and Eurasia (USDA, USDI 2000b). Unlike the other nitrogen-fixing lichens discussed below, *Lobaria hallii* was one of six species included in the Rare Nitrogen-fixing group for the FEMAT analysis (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Current information indicates that *Lobaria hallii* is not rare like other species in the Rare Nitrogen-fixing group. This species is widespread in the Northwest Forest Plan area (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b). Since 1993, the number of known sites has increased from 44 to 386, with 301 recent sites on federally managed land, and additional undocumented sites (USDA, USDI Species Review Panel 1999b and 2000b). *Lobaria hallii* has broad ecological amplitude and has been documented in a variety of habitats and on various substrates (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). It is found in a range of habitats from wetlands, swales, riparian areas, orchards, meadows, and low-elevation forests, to dry upland forests and ridgetops, oak savannahs, and rocky balds. It occurs in wet to dry sites, from low elevation to over 5,000 feet elevation (USDA, USDI 2000b). *Lobaria hallii* is widespread in various stand ages and successional stages and current information indicates this species is not closely associated with late-successional or old-growth forests (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). *Lobaria hallii* becomes more restricted on the east sides of the Cascades where it is found mainly on black cottonwood in riparian areas (McCune and Geiser 1997 and USDA, USDI 2000b).

*Lobaria pulmonaria* has a broad global distribution (Purvis et al. 1992) and is common and widespread in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b). This species occurs in a variety of habitats and stand ages, in moist hardwood and conifer forests, and in riparian areas, ranging from low to mid elevation (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). The number of known sites in the Northwest Forest Plan area has increased from 70 in 1993 to over 2,100, with over 1,800 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). There are also many undocumented sites as this is a common species and not routinely collected (USDA, USDI Species Review Panel 1999b).

*Lobaria scrobiculata* has a broad global distribution (Purvis et al. 1992), and is common and widespread in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b). This species occurs in a variety of habitats and stand ages. It is most frequent in low elevation hardwood forests, swamps, and oak savannahs west of the Cascades, but is also found in low to mid-elevation, late-successional or old-growth conifer forests; east of the Cascades, it occurs on sheltered, mossy outcrop areas, often near water (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). The number of known sites for this species in the Northwest Forest Plan area has increased from 26 in 1993 to over 200, with 152 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). This species is not closely associated with late-successional or old-growth forests.

*Nephroma helveticum*, *N. laevigatum*, *N. parile*, and *N. resupinatum* have broad global distributions (Purvis et al. 1992) and are widespread west of the Cascades (USDA, USDI Species Review Panel 1999b). *Nephroma parile* is more common east of the Cascades than the other *Nephroma* species (McCune and Geiser 1997). Since 1993, the number of known sites in the Northwest Forest Plan area has increased for the species: *N. helveticum* from 36 to 399, with 304 recent sites on federally managed land; *N. laevigatum* from 22 to 188, with 134 recent sites on federally managed land; *N. parile* from 12 to 78, with 60 recent sites on federally managed land; and *N. resupinatum* from 23 to 1,253, with 1,156 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). There are additional undocumented sites for these species (USDA, USDI Species Review Panel 1999b). These species are widespread and occur in various

habitats and stand ages, on trees, shrubs, and mossy rocks in moist hardwood and conifer forests, and riparian areas from low to mid-elevation, mainly west of the Cascades (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). *Nephroma laevigatum*, *N. parile* and *N. resupinatum* occur most frequently on hardwoods. *Nephroma parile* may occur in drier habitats than the other *Nephroma* species mentioned here. Current information indicates that *Nephroma parile* and *N. resupinatum* are not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). It is currently thought that *Nephroma parile* has a widespread geographic range in the Northwest Forest Plan area, its distribution is widespread but spotty within this range, and it occurs in isolated site clusters.

*Pannaria mediterranea* and *Peltigera collina* have broad global distributions (Purvis et al. 1992). *Pannaria leucostictoides* is endemic to western North America, from Alaska to California (Noble 1982, Goward et al. 1994, and McCune and Geiser 1997). These species are widespread and occur in various habitats and stand ages, on trees (mainly hardwoods), shrubs, and mossy rocks in moist hardwood and conifer forests, and riparian areas from low to mid-elevation, mainly west of the Cascades (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). *Peltigera collina* ranges from low elevations up into the subalpine (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased for these species: *Peltigera collina* from 36 to 639, with 420 recent sites on federally managed land, and *Pannaria leucostictoides* from 10 to 81, with 56 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). *Pannaria mediterranea* is a minute and inconspicuous species, and is difficult to survey for; known sites have increased from 2 to 18 since 1993, with 8 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). There are additional undocumented sites for these species. Current information indicates that *Pannaria leucostictoides*, *P. mediterranea*, and *Peltigera collina* are not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). Current information suggests that *Pannaria mediterranea* has a moderate geographic range within the Northwest Forest Plan area, its distribution is widespread but spotty within this range, and it occurs in isolated sites where it exists. It is currently thought that *P. leucostictoides* has a widespread geographic distribution, its distribution is widespread but spotty within its range, and it occurs in isolated site clusters.

*Peltigera neckeri* is widespread in the Northwest Forest Plan area, mainly at lower elevations west of the Cascade Crest (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites has increased for *Peltigera neckeri* from 6 to 19, with 7 recent sites on federally managed land (USDA, USDI Species Review Panel, 2000b), and there are additional undocumented sites. *Peltigera neckeri* is thought to be uncommon and it is documented from few sites, although survey efforts have been limited, and it may be under-collected (USDA, USDI Species Review Panel 1999b). *Peltigera neckeri* occurs across a range of stand ages and conditions. It occurs primarily in oak or other hardwood stands and riparian forests, and occasionally in moist conifer forests (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Current information indicates this species is not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 2000b). Current information suggests that *Peltigera neckeri* has a widespread geographic range in the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated sites.

*Pseudocyphellaria anomala* and *P. anthrapsis* are endemic to western North America (Noble 1982). These are common and widespread species and they occur in various habitats and stand ages. These species occur on trees (mostly hardwoods), shrubs, and occasionally mossy rocks in low to mid-elevation, moist hardwood and conifer forests and riparian areas, to somewhat open sites, mainly west of the Cascades (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased for these species: *Pseudocyphellaria anomala* from 52 to 1,045, with 862 recent sites on federally managed land, and *Pseudocyphellaria anthrapsis* from 51 to 1,925, with 1,667 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). There are additional undocumented sites for both species (USDA, USDI Species Review Panel 1999b).

*Pseudocyphellaria crocata*, *Sticta fuliginosa*, and *S. limbata* have broad global distributions (Purvis et al. 1992). These are common and widespread species, occurring in various habitats and stand ages. These species are found on trees (mainly hardwoods) and shrubs in low to mid-elevation moist hardwood and conifer forests and riparian areas, to somewhat open sites, valley bottoms, ash swamps, and oak savannah, mainly west of the Cascades (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased for these species: *Pseudocyphellaria crocata* from 17 to 242, with 194 recent sites on federally managed land; *Sticta fuliginosa* from 33 to 303, with 198 recent sites on federally managed land; and *Sticta limbata* from 11 to 171, with 103 recent sites on federally managed land (USDA, USDI Species Review Panel 2000b). There are additional undocumented sites for these species (USDA, USDI Species Review Panel 1999b).

*Lobaria hallii*, *L. pulmonaria*, *L. scrobiculata*, *Nephroma helveticum*, *N. laevigatum*, *N. resupinatum*, *Peltigera collina*, *Pseudocyphellaria anomala*, *P. anthrapsis*, *P. crocata*, *Sticta fuliginosa*, and *S. limbata* all have a similar distribution pattern. Current information suggest that these species have a widespread geographic range in the Northwest Forest Plan area, their distribution is widespread but spotty within their ranges, and there is the potential for limited connectivity among sites.

*Sticta beauvoisii* has not been documented in the Northwest Forest Plan area. The name is valid, but it has not been formally applied to any Pacific Northwest collections. This species was included in the FEMAT analysis based on interpretations of a lichenologist who was consulted during the development of the species list. There is no new information on this species. The specimens in the Pacific Northwest are considered *Sticta weigeli*, but there is still some taxonomic debate (USDA, USDI Species Review Panel 2000b). The geographic and biological distribution of this species is unknown.

### Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, all of these species except *Lobaria hallii* are in Category 4, and general regional surveys would be required. In the No-Action Alternative, *Lobaria hallii* is in Categories 1 and 3, where all current and future known sites would be managed, and extensive surveys would be required to determine high-priority sites for management.

All three action alternatives would remove these 17 nitrogen-fixing lichens from the Survey and Manage Standards and Guidelines because they do not meet one or more of the three basic criteria for inclusion in Survey and Manage. Current information indicates that *Sticta beauvoisii* does not occur in the Northwest Forest Plan area. The other nitrogen-fixing lichen species (except *Peltigera neckeri*) no longer meet the basic criteria for inclusion in the Survey and Manage Standards and Guidelines because the Northwest Forest Plan provides for reasonable assurance of persistence as indicated by their widespread distribution, abundance, and the availability of potential habitat in reserve land allocations. Also, several of these species do not meet the criterion of close association with late-successional or old-growth forests (*Lobaria hallii*, *Lobaria scrobiculata*, *Nephroma parile*, *Nephroma resupinatum*, *Pannaria leucostictoides*, *Pannaria mediterranea*, *Peltigera collina*, and *Peltigera neckeri*). A major concern for this group of species was not their rarity, but potential air pollution effects over the 100-year timeframe used in the FEMAT assessment. Air quality is managed primarily under the direction of laws, regulations, and policies (such as the Clean Air Act) that are outside the Northwest Forest Plan.

Under the No-Action Alternative, general regional surveys (Category 4) would be required for all of these species, except *Lobaria hallii*. These regional surveys would provide additional information on the distribution of these species, although it is already documented that these species (except *Sticta beauvoisii* and *Peltigera neckeri*) have widespread but spotty to widespread and even distributions within the Northwest Forest Plan area. An original concern for these species was potential air pollution effects; management under the No-Action Alternative would not address these concerns. The reserve land allocations and other standards and guidelines under

the Northwest Forest Plan provide habitat for these species that would maintain stable populations distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area, with a low to moderate level of uncertainty.

Currently, there is insufficient information for *Peltigera neckeri* and *Sticta beauvoisii* to determine how any alternative would affect their distribution and stability. The outcome for *Sticta beauvoisii* is uncertain under any alternative because this species is not known to occur in the Northwest Forest Plan area. *Peltigera neckeri* is known from few sites in the Northwest Forest Plan area, and there are few known sites on federally managed land, although there has been limited survey effort for this species. *Peltigera neckeri* is being evaluated for inclusion in the Agencies' special status species programs.

*Lobaria hallii* would receive additional protection under the No-Action Alternative (i.e. management of known sites) than under the action alternatives. Current information shows that *Lobaria hallii* is not as rare as indicated during previous assessments (USDA et al. 1993; USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b). This species is widespread but spotty in the Northwest Forest Plan area. The increase in our knowledge of its distribution, abundance, and broad ecological amplitude, in combination with the availability of potential habitat in the reserves, has greatly reduced the level of concern for this species. The reserve land allocations (including Riparian Reserves) and other standards and guidelines are likely to provide for stable populations of *Lobaria hallii* distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area under all alternatives.

### ***Heterodermia leucomelos*, *Kaernefeltia californica*, and *Loxosporopsis corallifera***

#### **Background and Affected Environment**

*Heterodermia leucomelos*, *Kaernefeltia californica* (formerly referred to as *Cetraria californica*), and *Loxosporopsis corallifera* were included in the Common Oceanic-Influenced Lichen group for the FEMAT analysis. Ratings were low for this group of four species because of their apparent rarity in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). At the time they were known only from one or few populations in the Northwest Forest Plan area and had limited distribution. In the Pacific Northwest, they occur along the immediate coast south into California and the populations are typically disjunct and isolated.

*Heterodermia leucomelos*, *Kaernefeltia californica*, and *Loxosporopsis corallifera* were determined to not be closely associated with late-successional or old-growth forests (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b). There are concerns for *Heterodermia leucomelos* and *Kaernefeltia californica* because there are low number of sites on federally managed land (USDA et al. 1993; USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b).

*Heterodermia leucomelos* is known to occur in western North America from British Columbia to California and has a broad global distribution (Purvis et al. 1992 and USDA and USDI 1999a). There are 34 records for this species in the ISMS database, with no recent sites reported from federally managed land (Table F-2). The recent Management Recommendation for this species reports 16 total sites in the Northwest Forest Plan area, eight in Oregon and eight in California (USDA, USDI 2000b). This difference in number of sites may be due to multiple records in the database collected from a single population. This species is found in Oregon on windswept headlands, particularly on the edges of dense thickets of Sitka spruce and shore pine (McCune et al. 1997 and USDA, USDI 2000b). It occurs in various habitats in California, ranging from coastal forests to shrub communities and oak woodlands (USDA, USDI 2000b). Current habitat data indicate this species is not closely associated with late-successional or old-growth forests. Current information suggests that this species has a limited overall geographic range in the Northwest Forest Plan area, its distribution is limited to a small portion within this range, and it occurs in isolated sites.

*Kaernefeltia californica* (referred to as *Cetraria californica* in USDA et al. 1993; USDA, USDI 1994b, Appendix J2; and USDA, USDI 1999b) is endemic to the west coast of North America, known from Alaska south to central California. It occurs along the narrow coastal strip in most of its range (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). This species is most common in the scrubby shore pine forests in coastal dunes, and also occurs on the edges of Sitka spruce forests (McCune and Geiser 1997; USDA, USDI 2000b; and Appendix J2 in USDA, USDI 1994b). It grows on bark, twigs, and cones of conifers, and on wooden fence posts and other structures (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). The number of known sites for this species in the Northwest Forest Plan area has increased from 17 to 56 since 1993, with about 10 known sites on federally managed land (USDA, USDI Species Review Panel 1999b). Current information indicates this species is more common than previously thought (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b), although its distribution is limited to a narrow coastal band. Given its occurrence in young stands and on wooden fences, this species does not meet the criteria for being closely associated with late-successional or old-growth forests. Current information suggests this species has a limited overall geographic range in the Northwest Forest Plan area, its distribution is limited to a small portion within this range, and it occurs in isolated site clusters or isolated sites.

*Loxosporopsis corallifera* is endemic to western North America and ranges from Alaska to California. The species is widespread and may be locally common in the Northwest Forest Plan area, particularly in the Oregon Coast Range and along the central Oregon Coast (USDA, USDI 2000b). Since 1993, the number of known sites for this species in the Northwest Forest Plan area has increased from 1 to 48, with 39 recent federal sites. About half of the known sites on federally managed land are in Late-Successional Reserves (USDA, USDI Species Review Panel 2000b). Information acquired since 1993 indicates *Loxosporopsis corallifera* is more widespread and common than was known during the FEMAT analysis (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; USDA, USDI Species Review Panel 1999b; and USDA, USDI 2000b).

*Loxosporopsis corallifera* occurs in various habitats and stand ages, including riparian areas and coastal dune wetlands. It is found on both conifer and deciduous trees, shrubs, snags, and stumps in low to mid-elevation, moist hardwood and conifer forests and shrub communities from the immediate coast to the Cascades. Habitat data indicate this species is not closely associated with late-successional or old-growth forests (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). Current information suggests this species has a widespread overall geographic range, its distribution is widespread but spotty, and it occurs in isolated sites or isolated site clusters.

### Environmental Consequences and Comparison of Alternatives

In the No-Action Alternative, *Heterodermia leucomelos*, *Kaernefeltia californica*, and *Loxosporopsis corallifera* are in Categories 1 and 3, which require management of all current and future known sites and extensive surveys. However, because of the few federal sites for *Heterodermia leucomelos* and *Kaernefeltia californica*, the requirement to manage known sites may not increase the likelihood that these species will maintain stable populations distributed in a pattern similar to or altered from its reference distribution on federally managed lands within the Northwest Forest Plan area under the No-Action Alternative. Many of the known sites for *Heterodermia leucomelos* and *Kaernefeltia californica* occur on nonfederal land, where known site management and survey requirements would not apply. These species would receive greater protection under the No-Action Alternative compared to the action alternatives because of these provisions.

In the three action alternatives, *Heterodermia leucomelos*, *Kaernefeltia californica*, and *Loxosporopsis corallifera* are proposed for removal from the Survey and Manage Standards and Guidelines because they do not meet the criterion of being closely associated with late-successional or old-growth forests. There is insufficient information for *Heterodermia leucomelos* and *Kaernefeltia californica* to determine how any alternative would affect their distribution and

stability because of the restricted distribution of these species in the Northwest Forest Plan area, and because few known sites occur on federally managed land. These species are being evaluated for inclusion in the Agencies' special status species programs.

*Loxosporopsis corallifera* may be locally common in the Oregon Coast Range or along the Oregon Coast. There may be concerns for this species in other parts of its range, given its current known spotty distribution, although the understanding of its distribution pattern may be a function of limited surveys in suitable habitat. *Loxosporopsis corallifera* would receive greater protection under the No-Action Alternative with management of known sites and extensive surveys. Current information indicates that *Loxosporopsis corallifera* is not as rare as previously thought, since a number of sites and a more widespread distribution have been documented since 1993.

Removal of *Loxosporopsis corallifera* from the Survey and Manage Standards and Guidelines under the action alternatives would not ensure management of known sites if these sites occur outside of reserve land allocations, nor would additional known sites be discovered through extensive surveys. This loss of known sites may lower the likelihood of maintaining stable populations distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area. However, about half of the known sites of this species occur in reserve land allocations which would increase the likelihood of maintaining stable populations distributed in a pattern similar to or altered from its reference distribution on federally managed lands within the Northwest Forest Plan area. There is little concern for this species in the Oregon Coast Range where it is reported as common; it is likely it would maintain stable populations and be distributed in a pattern similar to its reference distribution on federally managed lands within this portion of the Northwest Forest Plan area. Given the limited information on the distribution and abundance of this species outside of the Oregon Coast Range, the impact of the potential loss of sites in this area is highly uncertain. Since this species would not be managed under the Northwest Forest Plan area because it is not late-successional or old-growth associated, it is being evaluated for inclusion in the Agencies' special status species programs.

The No-Action Alternative provides a greater likelihood of maintaining stable populations of these three species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area because of the requirement to manage known sites and conduct extensive surveys to find additional sites. However, it is uncertain that management under the No-Action Alternative would maintain stable populations of *Heterodermia leucomelos* and *Kaernefeltia californica* distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area because of their limited distribution on federally managed land.

Inclusion of these three species in the special status species programs would provide an outcome similar to the No-Action Alternative with regards to maintaining stable populations distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area, although there is uncertainty of achieving this under both scenarios (No-Action Alternative and the special status species programs) for *Heterodermia leucomelos* and *Kaernefeltia californica*, given the low number of sites and limited distribution of these species on federally managed land.

### ***Erioderma sorediatum*, *Leioderma sorediatum*, and *Leptogium brebissonii***

#### **Background and Affected Environment**

*Erioderma sorediatum*, *Leioderma sorediatum*, and *Leptogium brebissonii* were included in the Rare Oceanic-Influenced Lichen group in the FEMAT analysis. The Rare Oceanic-Influenced Lichen group of 12 species had the lowest ratings for lichens in the FEMAT analysis. These ratings indicated a high level of concern for these species because of their rarity in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). At that time they

were known only from one or few populations in the Northwest Forest Plan area and had limited distribution. In the Pacific Northwest, they occur along the immediate coast south into California and the populations are typically disjunct and isolated.

*Erioderma soledatum* is found in western North America from Alaska to Oregon within the coastal fog belt, and also in New Zealand and the Philippines (USDA, USDI 2000b). This species was known only from three sites in 1993 (Appendix J2 in USDA, USDI 1994b). It is now known from 12 locations along the coast in the Northwest Forest Plan area. Only six sites are known to be on federally managed land; five are recent sites (USDA, USDI Species Review Panel 2000b). In Oregon, its distribution is limited to the extensive dune system between Heceta Head and Cape Arago. It has been found in open shore pine and Sitka spruce forests and shrub thickets on coastal dunes in Oregon, and on young red alder on the Olympic Peninsula (USDA, USDI 2000b).

*Leioderma soledatum* is found in western North America from British Columbia to Oregon, and has a broad global distribution (McCune et al. 1997). In 1993, it was known from two sites (in Oregon) in the Northwest Forest Plan area (Appendix J2 in USDA, USDI 1994b); one recent population was reported from private land on the Olympic Peninsula. Only the two Oregon sites occur on federally managed land. It has been found in semi-open coastal thickets on shrubs, in dune woodlands, and on young red alder in coastal forests (USDA, USDI 2000b).

*Leptogium brebissonii* occurs in western North America from Alaska to Oregon, and has a broad tropical distribution (McCune et al. 1997). It was known only from one location in 1993 (Appendix J2 in USDA, USDI 1994b), and is now known from 12 sites along the coast in the Northwest Forest Plan area (USDA, USDI Species Review Panel 2000b); seven are recent federal sites (USDA, USDI 2000b). It has been found in semi-exposed sites on shrubs, deciduous trees, and conifers in coastal forests and dunes, and in coastal wetland shrub thickets (USDA, USDI 2000b and McCune et al. 1997).

*Erioderma soledatum*, *Leioderma soledatum*, and *Leptogium brebissonii* were determined to not be closely associated with late-successional or old-growth forests (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b). There are high concerns for the persistence of these species (USDA et al. 1993; USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b). These lichens are rare in the Northwest Forest Plan area, and have a low number of known sites, low number of individuals, limited distribution, and narrow ecological amplitude. *Erioderma soledatum*, *Leioderma soledatum*, and *Leptogium brebissonii* all are thought to have similar distribution patterns. Current information suggests they have extremely limited overall geographic range within the Northwest Forest Plan area, their distribution is limited to a small portion within their ranges, and they occur in isolated sites.

## Environmental Consequences and Comparison of Alternatives

In the No-Action Alternative, *Erioderma soledatum*, *Leioderma soledatum*, and *Leptogium brebissonii* are in Categories 1 and 3, which requires management of all current and future known sites and extensive surveys. Management of known sites would help maintain the current distribution of populations on federally managed lands. However, because of the low number of federal sites for these species, the requirement to manage known sites may not increase the likelihood that these species will maintain stable populations distributed in a pattern similar to reference distributions on federally managed land in the Northwest Forest Plan area under the No-Action Alternative. About half of the known sites for these species occur on nonfederal land, where known site management and survey requirements would not apply. These species would receive greater protection under the No-Action Alternative compared to the action alternatives.

In the three action alternatives, *Erioderma soledatum*, *Leioderma soledatum*, and *Leptogium brebissonii* are proposed for removal from the Survey and Manage Standards and Guidelines because they do not meet the criterion of being closely associated with late-successional or old-growth forests. Because of the limited distribution and low number of sites on federally managed



land, all alternatives would provide inadequate habitat (including known sites) to maintain these species, although there is a high level of uncertainty associated with this outcome. As these species would not be managed under the Northwest Forest Plan under the action alternatives, they are being evaluated for inclusion in the Agencies' special status species programs.

### ***Leptogium saturninum***

#### **Background and Affected Environment**

*Leptogium saturninum* is widespread in the Northwest Forest Plan area, mainly at lower elevations west of the Cascade crest (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites has increased for *Leptogium saturninum* from 3 to 48, with 23 recent federal sites (USDA, USDI Species Review Panel 2000b), and additional undocumented sites (USDA, USDI Species Review Panel 1999b). *Leptogium saturninum* is noted as the most common gelatinous lichen in the Pacific Northwest (McCune and Geiser 1997).

*Leptogium saturninum* occurs in a range of stand ages and conditions. It occurs primarily in oak or other hardwood stands and riparian forests, and occasionally in moist conifer forests, and it also occurs on rock (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Current information indicates this species is not closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 2000b). Current information suggests that *Leptogium saturninum* has a widespread overall geographic range within the Northwest Forest Plan area, its distribution is widespread but spotty within this range, and it occurs in isolated site clusters.

#### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative *Leptogium saturninum* is in Category 4 and general regional surveys would be required. These regional surveys would provide additional information on the distribution of this species. In the three action alternatives, *Leptogium saturninum* is proposed for removal from the Survey and Manage Standards and Guidelines because it is not closely associated with late-successional or old-growth forests. Under all alternatives, there is no provision for management of known sites, yet there would be indirect management of populations of this species that occur within riparian reserves or other reserve land allocations.

*Leptogium saturninum* is widespread but spotty across the Northwest Forest Plan area, and is noted as the most common gelatinous lichen in the Pacific Northwest. It occurs primarily in riparian areas and hardwood stands at lower elevations. There has been an increase in the number of known sites for this species, although survey efforts have been limited. The majority of federal sites are in reserve land allocations. Based on this information, the reserve land allocations and other standards and guidelines of the Northwest Forest Plan would provide sufficient habitat (including known sites) to allow *Leptogium saturninum* to stabilize in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area. However, there is a high level of uncertainty associated with this outcome under all alternatives because *Leptogium saturninum* is primarily a low elevation species and about half of the known sites occur on nonfederal land.

### ***Hydrothyria venosa***

#### **Background and Affected Environment**

*Hydrothyria venosa* is known from the mountains of western North America and the Appalachians in eastern North America. *Hydrothyria venosa* is an aquatic lichen and grows on rock, and occasionally wood, in small, clear, cold streams and springs (McCune and Geiser 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). *Hydrothyria venosa* may not be closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). It spans a broad elevational range (1,150 to 7,000 feet) in the mountains from

Washington to California. Since 1993, the number of known sites in the Northwest Forest Plan area has increased from 35 to 130, with 89 recent federal sites (USDA, USDI Species Review Panel 2000b). All known sites on federally managed land are in Riparian Reserves, and 36 of these sites also occur in Congressionally Withdrawn Areas or Late-Successional Reserves. Current information suggests that *Hydrothyria venosa* has a widespread overall geographic range in the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated site clusters.

### **Environmental Consequences and Comparison of Alternatives**

In the No-Action Alternative, *Hydrothyria venosa* is in Categories 1 and 3, which requires management of all current and future known sites and extensive surveys. Management of known sites would help maintain the current distribution of populations on federally managed lands. *Hydrothyria venosa* would receive greater protection under the No-Action Alternative than the action alternatives.

In the three action alternatives, *Hydrothyria venosa* is proposed for removal from the Survey and Manage Standards and Guidelines because the reserve land allocations and Aquatic Conservation Strategy of the Northwest Forest Plan provide a reasonable assurance of species persistence.

*Hydrothyria venosa* is widely distributed across the Northwest Forest Plan area and there has been an increase in the number of known sites on federally managed land despite limited survey efforts. As an aquatic species, all sites are in riparian reserves, and a number occur in other reserve land allocations. It is likely that the Aquatic Conservation Strategy (as well as reserve land allocations and other standards and guidelines of the Northwest Forest Plan) under all alternatives, would provide sufficient habitat (including known sites) to allow *Hydrothyria venosa* to stabilize in a pattern similar to its reference distribution.

## **Lichens Proposed to Remain Under Survey and Manage Standards and Guidelines Under All Alternatives for Only a Portion of Their Ranges**

*Bryoria tortuosa*, *Collema nigrescens*, *Lobaria oregana*, *Tholurna dissimilis*, and *Usnea longissima* have different management direction applied across their range in the Northwest Forest Plan area under the action alternatives. The distribution and abundance of these species varies across the Northwest Forest Plan area, as do the concerns for maintaining stable populations of these species in different geographic areas. These species are assigned to different categories under the Survey and Manage Standards and Guidelines to apply management direction that will provide for stable populations distributed in a pattern similar to, or altered from, their reference distribution on federally managed lands within the Northwest Forest Plan area.

### ***Bryoria tortuosa***

#### **Background and Affected Environment**

*Bryoria tortuosa* was considered a Rare Forage Lichen for the FEMAT analysis. The viability ratings at that time reflected a high level of concern for this species because of its apparent rarity and limited distribution, and because it was only known from about 20 locations in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). More than 120 records are now reported for this species, with the majority of sites east of the Cascade crest and in southwestern Oregon (USDA, USDI Species Review Panel 1999b and 2000b). *Bryoria tortuosa* is known from less than 20 sites west of the Cascade crest and is still considered rare in this area (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). Most of the sites west of the Cascades are historic locations in the Puget Sound area, the Willamette Valley, and northern California. It is unknown if the species is still present at those sites, and nearly all of the historic sites were on nonfederal land (USDA, USDI 2000b). Since 1993, six recent sites have been reported from federally managed land (Table F-2). For these reasons, the range for this species

has been split into two geographic areas: (1) “West side Cascades” which includes the WA Olympic Peninsula, WA Western Lowlands, WA Western Cascades, OR Western Cascades, OR Coast Range, OR Willamette Valley, and CA Coast Range Physiographic Provinces; and, (2) “Drier climatic areas” which includes the WA Eastern Cascades, OR Eastern Cascades, OR Klamath, CA Klamath, and CA Cascades Physiographic Provinces.

*Bryoria tortuosa* is more common and abundant in the drier climatic areas of the Pacific Northwest. The species is known to be locally abundant in the dry forest zones of eastern Oregon and Washington, and southwestern Oregon, especially the Ponderosa Pine and Douglas-fir Zones (USDA, USDI Species Review Panel 1999b and 2000b). It grows on trees in well-lit, open stands, most frequently on oaks and pines, although it has been collected on a large variety of trees and shrubs (Brodo and Hawksworth 1977). It occurs in forests with frequent, natural, low-intensity fires, with many known sites on the east-side showing evidence of past fire events, including scarring of trees that now show large populations of the species (USDA, USDI 2000b).

Pre-disturbance surveys are considered practical for *Bryoria tortuosa* (USDA, USDI Species Review Panel 2000b and 2000c). This species is conspicuous and has distinctive coloration so it can be distinguished from other *Bryoria* species.

Current information suggests that *Bryoria tortuosa* has a limited distribution throughout the west side Cascades with a reference distribution of isolated sites within that range. In the drier portions of its range east of the Cascades and in southwest Oregon and northern California, the species is thought to be moderately widespread, but still limited within this range, and it occurs in isolated site clusters.

## Environmental Consequences and Comparison of Alternatives

### West side Cascades

Under the No-Action Alternative, *Bryoria tortuosa* is in Categories 1 and 3 throughout its range in the Northwest Forest Plan area. All current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

Under Alternatives 1 and 2, *Bryoria tortuosa* is in Category 1A and 2A, respectively. The management direction for Categories 1A and 2A is identical. All current and future known sites would be managed, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Under Alternative 3, *Bryoria tortuosa* is in Category 3A. All current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population, and could result in larger populations that have a higher likelihood of being stable over time compared to the other alternatives. Management of known sites would help provide for a distribution of populations in this part of its range. Since *Bryoria tortuosa* has a limited distribution with few known sites, and few sites on federally managed land, management of known sites may not increase the likelihood of maintaining stable populations distributed in a pattern similar to or altered from its reference distribution on federally managed lands within the Northwest Forest Plan area.

Strategic surveys would be conducted under all three action alternatives, and extensive surveys are required under the No-Action Alternative. These surveys could address the questions for management of this species, and could focus on likely habitats where the species may occur.

Additional known sites may be discovered and managed as a result of these surveys. Strategic surveys could provide information necessary to determine the appropriate management to reduce concerns for this species.

*Bryoria tortuosa* “west side Cascades” would receive greater protection under the three action alternatives than the No-Action Alternative because of the provision for pre-disturbance surveys. However, because this species has a restricted distribution in this geographic area, and little habitat is suspected to occur on federally managed land, it is likely that few new populations would be discovered. Sites discovered by these surveys would be managed and contribute to providing a distribution of populations across this part of its range in the Northwest Forest Plan area.

There is a high level of uncertainty that management of *Bryoria tortuosa* “west side Cascades” under any of the alternatives would result in stable populations on federally managed lands within the Northwest Forest Plan area. This is because of the few number of total sites and the low number of sites on federally managed land, along with the limited amount of potential suitable habitat on federally managed land. The concerns for maintaining stable populations on federally managed lands within the Northwest Forest Plan area is only slightly reduced under the action alternatives by the provision for pre-disturbance surveys prior to habitat-disturbing activities. While there is a high level of uncertainty due to lack of knowledge and stochastic events, all alternatives would provide inadequate habitat (including known sites) to maintain the species.

#### Drier climatic areas

Under the No-Action Alternative, *Bryoria tortuosa* is in Categories 1 and 3 throughout its range in the Northwest Forest Plan area. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

Under Alternative 1, *Bryoria tortuosa* is in Category 1D. Under this category, all current and future known sites would be managed until high-priority sites can be determined. Pre-disturbance surveys would not be conducted. Strategic surveys would be required to address species information and management needs.

Under Alternative 2, *Bryoria tortuosa* is in Category 2D. Under this category, all sites known as of September 30, 1999, would be managed, pre-disturbance surveys would not be conducted, and strategic surveys would be completed in 5 years.

Under Alternative 3, *Bryoria tortuosa* is in Category 3B. This category would require management of high-priority sites. Equivalent-effort surveys would be required prior to habitat-disturbing activities. Strategic surveys would be conducted to address species information and management needs.

Known site management varies for *Bryoria tortuosa* in this part of its range under the action alternatives. Under Alternatives 1 and 3, only the high-priority sites would be managed. The Management Recommendations for *Bryoria tortuosa* would identify the high-priority sites, but until that document is approved, all known sites would be managed. Sites that are considered not necessary for stability may be lost under Alternatives 1 and 3.

The least amount of site protection in the action alternatives occurs under Alternative 2, where only sites known as of September 30, 1999, would be managed. This could result in loss of sites that may be important for maintaining this species distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area. After 5 years, following completion of strategic surveys, *Bryoria tortuosa* in the “drier climatic areas” would be assigned to the Agencies’ special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. The current known sites are patchily distributed due, in part, to uneven survey effort. Therefore, limiting management of known sites to current levels may leave substantial gaps in the distribution.

Failure to manage for new sites located in these gaps would increase the uncertainty that Alternative 2 would provide for a stable population of *Bryoria tortuosa* distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area.

Pre-disturbance (equivalent-effort) surveys would occur for *Bryoria tortuosa* only under Alternative 3. These surveys would provide additional known sites if projects occurred in habitat occupied by *Bryoria tortuosa*. Sites that are discovered would be managed to provide for the species if they are identified as high-priority sites. The absence of pre-disturbance surveys in the other three alternatives may decrease the likelihood that the species would maintain stable populations if loss of sites occurs within a portion of its range where additional populations are necessary to provide for its distribution and abundance. However, because this species may be fairly common in suitable habitat in the drier climatic areas, and the provisions of the Northwest Forest Plan includes green tree retention and reserve land allocations, the likelihood of losing important sites would likely be moderate to low.

Strategic surveys would be required for *Bryoria tortuosa* under all action alternatives, although these surveys would be completed in 5 years in Alternative 2. These surveys occur as extensive surveys under the No-Action Alternative. Strategic surveys would: (1) determine what the level of concern is for *Bryoria tortuosa* in the drier climatic areas; (2) determine if the reserve land allocations provide for the species; (3) identify high-priority sites for management; and, (4) determine what the appropriate management is for *Bryoria tortuosa* in order to maintain populations on federally managed lands throughout this portion of its range in the Northwest Forest Plan area.

*Bryoria tortuosa* “drier climatic areas” receives the greatest management under Alternative 3, and the least management under Alternative 2. There is little difference in management for this species under the No-Action Alternative and Alternative 1, except the No-Action Alternative requires management of all known sites. It is likely that Alternatives 1 and 3 and the No-Action Alternative would provide sufficient habitat (including known sites) to allow *Bryoria tortuosa* to stabilize in a pattern similar to its reference distribution in the WA Eastern Cascades, OR Eastern Cascades, OR Klamath, CA Klamath, and CA Cascades Physiographic Provinces.

There is a high level of uncertainty that Alternative 2 would provide sufficient habitat (including known sites) to allow *Bryoria tortuosa* to stabilize in a pattern similar to its reference distribution on federally managed land within the drier part of its range in the Northwest Forest Plan area. The high level of uncertainty is because of the limitations with known site management under Alternative 2 with the restriction to only manage sites known as of September 30, 1999. It is uncertain if the current distribution of known sites is sufficient to allow *Bryoria tortuosa* to stabilize in a pattern similar to its reference distribution on federally managed land within the drier part of its range in the Northwest Forest Plan area.

### *Collema nigrescens*

#### **Background and Affected Environment**

*Collema nigrescens* was one of nine species included in the Riparian Lichen group for the FEMAT analysis (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). *Collema nigrescens* has a broad global distribution and occurs in western North America from Alaska to California (Purvis et al. 1992 and McCune and Geiser 1997). Based on the current data in the ISMS database, this species is widespread but spotty in southern Oregon and northern California. Since 1993, the number of known sites in the OR Klamath, CA Klamath, and CA Coast Physiographic Provinces of the Northwest Forest Plan area has increased from 2 to 474, with 431 recent sites on federally managed land (Table F-2). Many of these sites are in reserve land allocations (USDA, USDI Species Review Panel 1999b). There are relatively few documented locations for *Collema nigrescens* north of the OR Klamath Physiographic Province through Washington. There are 28 known sites for this part of the Northwest Forest Plan area; 16 are recent federal sites (Table F-2).

For these reasons, the range for this species has been split into two geographic areas: (1) the OR Klamath, CA Klamath, and CA Coast Range Physiographic Provinces; and, (2) Washington and Oregon except the OR Klamath Physiographic Province.

*Collema nigrescens* occurs primarily on deciduous trees and shrubs, and occasionally on mossy rock, mainly west of the Cascades (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). It occurs in low elevation hardwood forests, in a fairly wide range of habitat conditions and stand ages, especially in moist or riparian forests (McCune and Geiser 1997). This species may not be closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b).

Current information suggests that *Collema nigrescens* is considered to have a widespread geographical range in the Klamath basin and southern areas within the Northwest Forest Plan area, and a spotty distribution within that overall range, with the potential for limited connectivity among sites and clusters. In the balance of its range in Washington and Oregon outside of the Klamath province, the species is limited throughout, with a reference distribution pattern of isolated sites within this area.

### **Environmental Consequences and Comparison of Alternatives**

#### **OR Klamath, CA Klamath, and CA Coast Range Physiographic Provinces**

Under the No-Action Alternative, *Collema nigrescens* is in Category 4 across its entire range in the Northwest Forest Plan area and general regional surveys would be required. These regional surveys would provide additional information on the distribution of this species, although it is already documented that the species is widespread but spotty within this southern part of its range in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b).

All three action alternatives would remove *Collema nigrescens* from the Survey and Manage Standards and Guidelines in the OR Klamath, CA Klamath, and CA Coast Range Physiographic Provinces. In this part of its range, *Collema nigrescens* no longer meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines because the Northwest Forest Plan provides for a reasonable assurance of persistence as indicated by its widespread distribution, abundance, and by the number of known sites and availability of potential habitat in reserve land allocations (USDA, USDI Species Review Panel 1999b). All alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

#### **Washington and Oregon except OR Klamath Physiographic Province**

In the three action alternatives, the status of *Collema nigrescens* is undetermined in Washington and Oregon (except the OR Klamath Physiographic Province). There is uncertainty regarding concerns for maintaining a stable population of *Collema nigrescens* in this part of its range on federally managed lands within the Northwest Forest Plan area, and whether the species meets the basic criteria for Survey and Manage (i.e., closely associated with late-successional or old-growth forests, and do the reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance of persistence).

Under Alternative 1, *Collema nigrescens* is in Category 1F, where strategic surveys would be conducted to determine if the species meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines. Under Alternative 2, *Collema nigrescens* is in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Under Alternative 3, *Collema nigrescens* is in Category 3C. Under this category, all current and future known sites would be managed, and strategic surveys would be conducted to determine if the species meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines.

Known site management varies for *Collema nigrescens* under the different alternatives. Alternative 3 provides the greatest protection for sites of this species, as all current and new known sites would be managed. There is no site management requirement under the No-Action Alternative and Alternative 1. Under Alternative 1, known sites would receive no protection while strategic surveys would determine management necessary to provide for a stable population of *Collema nigrescens* distributed in a pattern similar to, or altered from, its reference distribution on federally managed lands in this portion of its range within the Northwest Forest Plan area. Concerns for the species may be increased under Alternative 1 and the No-Action Alternative if it is later determined that these sites were important for maintaining the species.

Under Alternative 2, only sites known as of September 30, 1999, would be managed and there would be no pre-disturbance surveys. This may result in loss of sites that are important to maintaining a stable population of *Collema nigrescens* throughout this part of its range on federally managed lands within the Northwest Forest Plan area. Following completion of strategic surveys after 5 years, this species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Under all alternatives, there would be indirect management of populations of *Collema nigrescens* that are associated with riparian forests. A portion of its populations may be provided for by the reserve land allocations, particularly riparian reserves, even under alternatives where there is no management of known sites. However, it is unknown what the contribution of sites in the Riparian Reserves and other reserve allocations will be in providing for a stable population of *Collema nigrescens* in this part of its range.

Strategic surveys would be required for this species under the three action alternatives, and as general regional surveys under the No-Action Alternative. Under Alternative 2, however, these surveys would be completed within 5 years. These surveys could provide information regarding the distribution, habitat requirements, and expected populations of *Collema nigrescens* throughout this part of its range in the Northwest Forest Plan area. Information from these surveys could help determine: (1) if the species is closely associated with late-successional or old-growth forests; (2) if the reserve land allocations provide for the species; and, (3) the appropriate management to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Strategic surveys could be effective in gathering information about this species, as they would focus in areas with a high likelihood of locating the species. Strategic surveys could provide the information necessary to determine the appropriate management to address concerns for this species throughout this part of its range in the Northwest Forest Plan area.

Alternative 3 would provide the most management for *Collema nigrescens* in Washington and Oregon outside of the OR Klamath Physiographic Province. The least protection for *Collema nigrescens* occurs under the No-Action Alternative and Alternative 1 because there is no requirement for managing known sites. Alternative 2 is only slightly better than the No-Action Alternative and Alternative 1 because of the requirement for known site management; however, there are few federal sites for this species in this part of its range as of September 30, 1999. However, there is insufficient information regarding *Collema nigrescens* in Washington and Oregon outside of the OR Klamath Physiographic Province to determine how any alternative would affect its distribution and stability.

### ***Lobaria oregana***

#### **Background and Affected Environment**

*Lobaria oregana* was one of 20 species included in the Nitrogen-fixing Lichen group for the FEMAT analysis (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). *Lobaria oregana* is endemic to western North America (Goward et al. 1994 and McCune and Geiser 1997), with a widespread but spotty distribution in Oregon and Washington (USDA, USDI Species Review Panel 2000b). Since 1993, the number of known sites for this species in the Northwest Forest Plan

area in Oregon and Washington has increased from 42 to 544, with 448 recent sites on federally managed land, and many additional sites not reported to the ISMS database (USDA, USDI Species Review Panel 1999b and Mt. Baker-Snoqualmie and Olympic National Forests Ecology Program data files). *Lobaria oregana* is widespread on trees (mainly conifers) and shrubs in low to mid-elevation mesic to moist conifer and hardwood forests, and riparian areas, west of the Cascade crest in Oregon and Washington. It is most abundant in low to mid-elevation, late-successional or old-growth forests (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b).

*Lobaria oregana* becomes more restricted in distribution in California (USDA, USDI Species Review Panel 2000b). Hale (1988) notes the species is rare in California, and is restricted to Humboldt and Del Norte Counties. There, it occurs in low elevation, moist conifer forests in the North Coast Ranges (Hale 1988). The ISMS database has only seven reported sites for California; six are recent federal sites (see Table F-2). For these reasons, the range for this species has been split into two geographic areas: (1) Washington and Oregon; and, (2) California.

Pre-disturbance surveys are considered practical for *Lobaria oregana* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). The species is conspicuous, has a distinctive growth form, and can be easily located and identified in the field.

Current information suggests that *Lobaria oregana* has a widespread geographical range within the Washington and Oregon portion of the Northwest Forest Plan area, and a spotty distribution within that overall range, with the potential for limited connectivity among sites and clusters. Within the California portion of the Northwest Forest Plan area, *Lobaria oregana* is very limited in distribution, it occurs only within a small portion of this range, and it is found in isolated sites.

## **Environmental Consequences and Comparison of Alternatives**

### **Washington and Oregon**

Under the No-Action Alternative, *Lobaria oregana* is in Category 4 throughout its entire range in the Northwest Forest Plan area and general regional surveys would be required. These regional surveys would provide additional information on the distribution of this species, although it is already documented to be widespread throughout its range in Oregon and Washington (USDA, USDI Species Review Panel 1999b). An original concern for this species was potential air pollution effects (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b). Management under the No-Action Alternative would not address this concern.

All three action alternatives would remove *Lobaria oregana* in Washington and Oregon from the Survey and Manage Standards and Guidelines. In this part of its range, *Lobaria oregana* no longer meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines because the Northwest Forest Plan provides for reasonable assurance of persistence as indicated by its widespread distribution, abundance, the number of known sites, and availability of potential habitat in reserve land allocations (USDA, USDI Species Review Panel 1999b). A concern for this species was not its rarity, but potential air pollution effects over the 100-year timeframe used in the FEMAT assessment. Air quality is managed outside of the Northwest Forest Plan under the direction of other laws and regulations, such as the Clean Air Act. All alternatives would provide sufficient habitat (including known sites) to allow *Lobaria oregana* to stabilize in a pattern similar to its reference distribution in Oregon and Washington.

### **California**

Under the No-Action Alternative, *Lobaria oregana* is in Category 4 throughout its entire range in the Northwest Forest Plan area, and general regional surveys would be required. These regional surveys would provide additional information on the distribution of this species, including the California portion of its range.



Management for *Lobaria oregana* in California is increased under the action alternatives compared to the No-Action Alternative. *Lobaria oregana* is in Category 1A in Alternative 1, 2A in Alternative 2, and 3A in Alternative 3. There is a high concern for this species in California because it is restricted in distribution and known from few sites.

The management direction for Categories 1A and 2A is identical. All current and future known sites would be managed and pre-disturbance surveys would be conducted. Strategic surveys would be conducted to address species information and management needs.

Under Category 3A, all current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance (equivalent-effort) surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Management of known sites for *Lobaria oregana* is required under all action alternatives. Under Alternatives 1 and 2, management would be to maintain the persistence of the species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in a higher likelihood of stable populations over time. Since *Lobaria oregana* may require interior microclimate, site management for this species would be similar under all action alternatives. Management of known sites would help maintain the current distribution of populations on federally managed lands in California. However, since *Lobaria oregana* has a limited distribution in this part of its range, and few known sites on federally managed land, the management of known sites may not increase the likelihood of maintaining a stable population for this species distributed in a pattern similar to or altered from its reference distribution in the California portion of federally managed lands within the Northwest Forest Plan area.

Pre-disturbance survey requirements are the same for *Lobaria oregana* under the action alternatives. Pre-disturbance surveys are required and these surveys are likely to discover additional sites of *Lobaria oregana* if it occurs in project areas. Sites discovered by these surveys would be managed and contribute to providing for populations of this species across this part of its range in California.

*Lobaria oregana* would receive greater protection under the three action alternatives than the No-Action Alternative because of the provision for known site management and pre-disturbance surveys. Because this species appears to have a restricted distribution in this part of its range, it is unknown how many new sites will be discovered through pre-disturbance surveys. Sites discovered by these surveys would be managed and contribute to providing a distribution of populations across this part of its range in the Northwest Forest Plan area.

Strategic surveys would be required under all action alternatives to gather the information needed to maintain stable populations of this species distributed in a pattern similar to, or altered from, its reference distribution across the California portion of its range on federally managed lands within the Northwest Forest Plan area. Similar general regional surveys would be conducted under the No-Action Alternative. These surveys under all alternatives would: (1) be effective in providing for species persistence as they can be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; and, (3) narrow the habitat where pre-disturbance surveys would be required. Sites discovered by these surveys would be managed and would contribute to providing for a distribution of populations across this portion of its range in the Northwest Forest Plan area. Strategic surveys could provide needed information to determine the appropriate management for reducing concerns for *Lobaria oregana* in California.

The action alternatives provide greater management for *Lobaria oregana* in this part of its range, because of the requirement for known site management and pre-disturbance surveys. However, because of the limited distribution of this species in California, and the few sites on federally

managed land, all alternatives would provide inadequate habitat (including known sites) to maintain the species. The level of uncertainty associated with this outcome is moderate under the No-Action Alternative and high for Alternatives 1, 2, and 3. Uncertainty is due to lack of knowledge about this species in this part of its range and the potential for stochastic events to affect populations.

### *Tholurna dissimilis*

#### **Background and Affected Environment**

*Tholurna dissimilis* is known from North America and Scandinavia. In the Northwest Forest Plan area, this species is known from Washington south into Oregon where it reaches its southern extent in the central Oregon Cascades (USDA, USDI 2000b). In the Pacific Northwest, it occurs on krummholz or flag-form subalpine fir and Engelmann spruce on windswept ridges in the upper montane and subalpine zones up to timberline (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). It has also been found on the dead tops of two Douglas-fir trees at 1,100 feet elevation at the Wind River Canopy Crane site in southern Washington. One site (no longer extant) was on an ornamental birch tree less than 20 years old. The species ranges from near sea level to 6,700 feet. This species may not be closely associated with late-successional or old-growth forests. The number of known sites in the Northwest Forest Plan area has increased from 9 to 21 since 1993 (USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b). Eighteen of these sites are in Washington. All known sites but one are on federally managed land. The majority of known sites in Washington are in reserve land allocations (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). The ISMS database shows fewer sites for Washington than reported in the recent management recommendation (USDA, USDI 2000b).

*Tholurna dissimilis* is known from three widely scattered locations in the Oregon Cascades, all on federally managed land (USDA, USDI 2000b). There are no recent federal sites reported from Oregon (Table F-2). The rarity of *Tholurna dissimilis*, its sparseness, and stunted condition suggest that conditions at the southernmost site are near the limit for its growth (Pike 1972). Known populations in Oregon are at high elevations in timberline or alpine situations (USDA, USDI 2000b). This habitat is limited in extent in the Oregon Cascades. Concerns for this species in Oregon have not changed since the FEMAT analysis when a high level of concern was indicated for its persistence under Option 9 (USDA et al. 1993; USDA, USDI 2000b; and Appendix J2 in USDA, USDI 1994b). For these reasons, the range for this species has been split into two geographic areas: (1) North of the Columbia River; and, (2) South of the Columbia River.

Current information suggests that *Tholurna dissimilis* has a moderately widespread geographical range within the Northwest Forest Plan area north of the Columbia River, and a limited distribution throughout that overall range. The reference distribution for this species is considered to be isolated sites. South of the Columbia River, the species has a very limited distribution and is limited to a small portion of that range. The species reference distribution appears to be restricted to isolated sites in Oregon.

Pre-disturbance surveys are considered not practical for *Tholurna dissimilis* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). Although distinctive, this species is very small and it is difficult to consistently locate in the field. The habitat it occupies may not be accessible when it occurs in the tops of old-growth trees or along exposed ridgetops (USDA, USDI Species Review Panel 1999b).

#### **Environmental Consequences and Comparison of Alternatives**

*Tholurna dissimilis* remains a concern of not maintaining a stable population in Oregon, but is of less concern in Washington (USDA, USDI 2000b). The species range is split under the action alternatives to apply different management direction in Oregon and Washington.

Under the No-Action Alternative, *Tholurna dissimilis* is in Categories 1 and 3 throughout its range in the Northwest Forest Plan area. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

#### North of the Columbia River

*Tholurna dissimilis* north of the Columbia River would receive greater protection under the No-Action Alternative than the action alternatives. Under the action alternatives, *Tholurna dissimilis* is proposed for removal from the Survey and Manage Standards and Guidelines. The increase in the number of known sites, and the increase in our knowledge of the habitat where this species occurs, has increased the likelihood that the Northwest Forest Plan will provide for a stable population of *Tholurna dissimilis* distributed in a pattern similar to, or altered from, its reference distribution on federally managed lands north of the Columbia River within the Northwest Forest Plan area. The habitat this species occupies at timberline is typically not subject to management that would impact populations and the majority of this habitat is in Congressionally Withdrawn Areas in Washington. The recent discovery of a population in dead tops of old-growth Douglas-fir indicates a broader ecological distribution than originally thought. Occurrences in the upper crown of trees and at exposed ridgetop sites indicate that *Tholurna dissimilis* tolerates exposed habitats. The reserve land allocations and standards and guidelines of the Northwest Forest Plan, such as green tree retention and 15 percent retention of late-successional stands in watersheds, would provide habitat for stable populations of *Tholurna dissimilis*. All alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution in Washington north of the Columbia River.

#### South of the Columbia River

*Tholurna dissimilis* in Oregon is in Category 1B under Alternative 1 and Category 2B under Alternative 2. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for this species because of its cryptic form and the difficulty locating it in the field. Strategic surveys would be conducted to address species information and management needs.

*Tholurna dissimilis* in Oregon is in Category 3A under Alternative 3. All current and future known sites would be managed with a 250-meter buffer. Pre-disturbance (equivalent-effort) surveys would be conducted, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites is required under all alternatives. Under the No-Action Alternative, and Alternatives 1 and 2, management would be to maintain the species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. Management of known sites would help provide for a distribution of populations. However, since *Tholurna dissimilis* has a restricted distribution in Oregon, and is known from few sites on federally managed land, there is a high level of uncertainty that management of known sites would increase the likelihood of maintaining a stable population of *Tholurna dissimilis* in Oregon.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for *Tholurna dissimilis* in Oregon under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. However, because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, and given the difficulty in finding this species, these surveys are likely to provide limited additional information for management. There would be a moderate risk of loss of sites under Alternatives 1 and 2 and the No-Action Alternative because surveys prior to habitat-disturbing activities would not be conducted. This potential loss of sites could eliminate populations that are important to provide

for a stable population of *Tholurna dissimilis* distributed in a pattern similar to its reference distribution throughout its range in Oregon on federally managed lands within the Northwest Forest Plan area. Pre-disturbance surveys are considered not practical for this species.

Strategic surveys would be conducted under all three action alternatives, and extensive surveys under the No-Action Alternative. These surveys could address the questions for management of *Tholurna dissimilis* in Oregon and could focus on likely habitats where the species may occur. Additional known sites may be discovered and managed as a result of these surveys. Strategic surveys could provide information necessary to determine the appropriate management to reduce concerns for this species in this part of its range.

*Tholurna dissimilis* is thought to be rare in Oregon as it is known from only three locations. If the habitat at known sites in Oregon is typical for this species, then potential habitat is limited in extent in this part of its range. It is unknown if *Tholurna dissimilis* will occur in the tops of old-growth trees in Oregon, although the recent discovery in southern Washington indicates there may be potential for it to occur in this habitat farther south. Based on what is currently known about this species in Oregon, there is insufficient information regarding *Tholurna dissimilis* in Oregon to determine how any alternative would affect its distribution and stability.

### *Usnea longissima*

#### **Background and Affected Environment**

*Usnea longissima* was one of nine species included in the Riparian Lichen group for the FEMAT analysis (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). *Usnea longissima* is known to occur in western North America from Alaska to California, and in Europe. The number of known sites for this species in the Northwest Forest Plan area has increased from 23 to 206 since 1993, with numerous additional undocumented sites (Appendix J2 in USDA, USDI 1994b and USDA, USDI Species Review Panel 2000b). There are about 100 recent federal sites in Washington and in Oregon outside of Curry, Josephine, and Jackson Counties (see Table F-2).

*Usnea longissima* becomes more restricted in distribution in the southern part of the Northwest Forest Plan area. In California it is rare and occurs from Humboldt County south to San Francisco Bay (Hale 1988). There are 10 recent sites reported from California and southern Oregon in Curry, Josephine, and Jackson Counties (see Table F-2). *Usnea longissima* is on the California Lichen Society's Red List for Del Norte, Humboldt, and Mendocino Counties. This list contains those lichen species thought to be rare or endangered in California. For these reasons, the range for this species has been split into two geographic areas: (1) California and Curry, Josephine, and Jackson Counties in Oregon; and, (2) Washington and Oregon excluding Curry, Josephine, and Jackson Counties.

*Usnea longissima* is found on both conifer and deciduous trees in somewhat open, moist hardwood and conifer forests, and riparian areas at lower elevations, west of the Cascade crest. The majority of the known sites on federally managed land are in reserve land allocations. This species is widespread and may be locally abundant. It occurs in various habitats and stand ages, especially riparian and wetland communities (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). A recent study in the Oregon Coast Range reports large populations in late-successional or old-growth forests on ridges and upper slopes (Keon 1999 and USDA, USDI Species Review Panel 2000b). Concern was expressed for *Usnea longissima* during the FEMAT analysis due to declines of this species in Europe, air quality concerns, commercial harvesting as a special forest product, and cumulative effects on nonfederal land (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b).

Current information suggests that *Usnea longissima* has a widespread geographical range within the northern portion of its range in the Northwest Forest Plan area, and a spotty distribution within that overall range. The reference distribution for this species is considered to be isolated sites and site clusters. Within the southern portion of its range in the Northwest Forest Plan area, the

species is thought to have a limited distribution, and is further limited throughout that area. The reference distribution consists of isolated sites within the southern part of its range.

Pre-disturbance surveys are considered practical for *Usnea longissima* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). This species is conspicuous, has a distinctive growth form, and can be easily located and identified in the field.

### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, *Usnea longissima* is in Category 4 throughout its entire range in the Northwest Forest Plan area and general regional surveys would be required. These regional surveys would provide additional information on the distribution of this species, although it is already documented to have a widespread but spotty distribution throughout most of its range in Oregon and Washington (USDA, USDI Species Review Panel 1999b). Original concerns for this species included potential air pollution effects and cumulative effects on nonfederal land; management under the No-Action Alternative would not address these concerns.

Washington and Oregon outside of Curry, Josephine, and Jackson Counties

In the three action alternatives, the status of *Usnea longissima* is undetermined in Washington and Oregon (outside of Curry, Josephine, and Jackson Counties). There is a moderate level of uncertainty for maintaining a stable population distributed in a pattern similar to, or altered from, its reference distribution on federally managed lands within the Northwest Forest Plan area, and whether this species meets the basic criteria for Survey and Manage (i.e., is the species closely associated with late-successional or old-growth forests, and do the reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance of persistence?).

Under Alternative 1, *Usnea longissima* is in Category 1F, where strategic surveys would be conducted to determine if the species meets the basic criteria for inclusion under the Survey and Manage Standards and Guidelines. Under Alternative 2, it is in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Under Alternative 3, it is in Category 3C. Under 3C, all current and future known sites would be managed and strategic surveys would be conducted to determine if the species meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines.

Known site management varies for *Usnea longissima* under the different alternatives. Alternative 3 provides the greatest protection for sites of this species, as all current and new known sites would be managed. There is no site management required under the No-Action Alternative and Alternative 1. Under Alternative 1, known sites would receive no protection while strategic surveys would determine management necessary to provide for stable population of *Usnea longissima* distributed in a pattern similar to, or altered from, its reference distribution in this portion of its range on federally managed lands within the Northwest Forest Plan area. Concerns for the species may be increased under Alternative 1 and the No-Action Alternative if it is later determined that these known sites were important for maintaining this species. Because of the moderate to high number of sites, the majority of which are in reserve land allocations, this concern is probably low throughout most of its range in Washington and in Oregon outside of Curry, Josephine, and Jackson Counties.

Under Alternative 2, only sites known as of September 30, 1999, would be managed and there would be no pre-disturbance surveys. This may result in loss of sites that may be important to maintain a stable population of *Usnea longissima* distributed in a pattern similar to, or altered from, its reference distribution throughout this part of its range on federally managed lands within the Northwest Forest Plan area. Following completion of strategic surveys after 5 years, this species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Under all alternatives, there would be indirect management of populations of *Usnea longissima* that are associated with riparian forests. Many of its local populations may be provided for by reserve land allocations, particularly Riparian Reserves, even under alternatives where there is no management of known sites. Because *Usnea longissima* is often, although not exclusively, associated with riparian areas it is likely that sites in Riparian Reserves and other reserve allocations will make a substantial contribution towards providing for stable populations of *Usnea longissima* in a widespread but spotty distribution in Washington, and in Oregon outside Curry, Josephine, and Jackson Counties, as long as treatments in the riparian areas and reserve land allocations maintain or provide the habitat conditions required by *Usnea longissima*.

Strategic surveys would be required for this species under the three action alternatives, and as general regional surveys under the No-Action Alternative. Under Alternative 2 these surveys would be completed within 5 years. These surveys would provide information regarding the distribution, habitat requirements, and expected populations of *Usnea longissima* throughout this part of its range in the Northwest Forest Plan area. Information from these surveys would help determine: (1) if the species is closely associated with late-successional or old-growth forests; (2) if the reserve land allocations provide for the species; and, (3) the appropriate management needed to maintain stable populations distributed in a pattern similar to, or altered from, its reference distribution on federally managed lands within the Northwest Forest Plan area. Strategic surveys would be effective in gathering information about this species because they would focus in areas with a high likelihood of locating the species. Strategic surveys could provide the information necessary to determine the appropriate management to address concerns for *Usnea longissima* in Washington and in Oregon outside of Curry, Josephine, and Jackson Counties.

In conclusion, Alternative 3 would provide the most protection for *Usnea longissima* in Washington and in Oregon outside of Curry, Josephine, and Jackson Counties. The least protection for *Usnea longissima* occurs under the No-Action Alternative and Alternative 1 because there is no requirement for managing known sites. Alternative 2 provides greater management than the No-Action Alternative and Alternative 1, because of the requirement for known site management. Because known site management includes only sites known as of September 30, 1999, there could be gaps in site management in this part of the range of *Usnea longissima*. Not managing known sites in these areas may prevent maintaining a stable population of *Usnea longissima* distributed in a pattern similar to, or altered from, its reference distribution in this part of its range on federally managed lands within the Northwest Forest Plan area. While there is a high level of uncertainty, the No-Action Alternative and Alternative 1 would provide habitat (including known sites) sufficient to allow species to stabilize in a pattern different from its reference distribution. This same conclusion applies to Alternative 2, but with a moderate level of uncertainty and to Alternative 3 with a low level of uncertainty. However, the risk is probably not high under any alternative, and may be localized in certain geographic areas.

California, and Curry, Josephine, and Jackson Counties, Oregon

Management for *Usnea longissima* in this part of its range is increased under the action alternatives compared to the No-Action Alternative. *Usnea longissima* is in Category 1A in Alternative 1, 2A in Alternative 2, and 3A in Alternative 3. There is a high concern for this species in this part of its range because it is restricted in distribution and known from few sites.

The management direction for Categories 1A and 2A is identical. All current and future known sites would be managed and pre-disturbance surveys would be required. Strategic surveys would be conducted to address species information and management needs.

Under Category 3A, all current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Management of known sites for *Usnea longissima* is required under all action alternatives. Under Alternatives 1 and 2, management would be to maintain the species at the site. Under Alternative

3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. Management of known sites would help maintain the current distribution of populations on federally managed lands in California and in Curry, Josephine, and Jackson Counties, Oregon. However, since *Usnea longissima* has a limited distribution in this part of its range, and few known sites on federally managed land, the management of known sites may not increase the likelihood of maintaining a stable population for this species distributed in a pattern similar to, or altered from, its reference distribution in this part of its range on federally managed lands within the Northwest Forest Plan area.

Pre-disturbance survey requirements are the same for *Usnea longissima* under the action alternatives. Pre-disturbance surveys are required and these surveys are likely to discover additional sites of *Usnea longissima*. Sites discovered by these surveys would be managed and contribute to providing for a distribution of populations across this part of the species' range.

*Usnea longissima* would receive greater protection under the three action alternatives than the No-Action Alternative because of the provision for known site management and pre-disturbance surveys. Because this species appears to have a restricted distribution in this part of its range, it is unknown how many new sites will be discovered through predisturbance surveys. Sites discovered by these surveys would be managed and contribute to providing a distribution of populations across this part of its range.

Strategic surveys would be required under all action alternatives to gather the information needed to manage this species to maintain stable populations across this portion of its limited range. Similar general regional surveys would be conducted under the No-Action Alternative. These surveys under all alternatives would: (1) be effective in contributing information to provide for the species, as they can be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; and, (3) narrow the habitat where pre-disturbance surveys would be required. Sites discovered by these surveys would be managed and would contribute to providing a distribution of populations across this part of its range. Strategic surveys could provide needed information to determine the appropriate management for reducing concerns for *Usnea longissima* in California and Curry, Josephine, and Jackson Counties, Oregon.

The action alternatives provide greater management for *Usnea longissima* in this part of its range because of the requirement for known site management and pre-disturbance surveys. However, because of the limited distribution of this species in California and southwest Oregon, and the few sites on federally managed land, all alternatives would provide inadequate habitat (including known sites) to maintain the species. The level of uncertainty associated with this outcome is moderate under the No-Action Alternative and high for Alternatives 1, 2, and 3. Uncertainty is due to lack of knowledge about this species in this part of its range and the potential for stochastic events to affect populations.

## **Lichens Proposed to Remain Under Survey and Manage Standards and Guidelines Under All Alternatives**

### ***Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis***

#### **Background and Affected Environment**

*Hypogymnia duplicata* is endemic to the Pacific Northwest and is known to occur from Alaska to northwestern Oregon (USDA, USDI 2000b). It was one of two species in the Rare Leafy Arboreal Lichen group for the FEMAT analysis. Low ratings for this group indicated high concern for this species because of its limited distribution, apparent rarity, and sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Since 1993, the number of known sites for this

species in the Northwest Forest Plan area has increased from 14 to more than 70, with 56 recent federal sites (see Table F-2). Most of the known sites are in northwestern Washington and the majority occur on federally managed land (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). This species is found in old-growth forests in high precipitation areas, between 1,100 and 5,500 feet elevation, in the western Cascades, Olympic Mountains, and Oregon Coast Range (McCune and Geiser 1997 and USDA, USDI 2000b). Populations of this species occur sporadically across the landscape, and it is seldom abundant where it occurs. Known sites become limited south of Snoqualmie Pass, possibly because of limited availability of suitable habitat. Since 1993, concerns have decreased for this species in northern Washington because of the increase in number of sites, although it is still restricted to specific habitat conditions and considered rare (USDA, USDI 2000b). Current information suggests that *Hypogymnia duplicata* has a moderately widespread geographical range within the Northwest Forest Plan area, but is limited to a small portion of that overall range. The reference distribution for this species is considered to be limited to isolated sites in southwest Washington and Oregon and isolated sites and clusters in northwestern Washington.

*Lobaria linita* occurs sporadically in northern Europe and Asia, and is known to occur in North America from Alaska to northern Oregon (USDA, USDI 2000b). It was one of six species included in the Rare Nitrogen-fixing Lichen group for the FEMAT analysis. Low ratings for this group indicated high concern for this species because of its limited distribution, apparent rarity, and sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Since 1993, the number of known sites has increased from 10 to 89, with 42 recent federal sites (USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b and 2000c). Some of these records represent the subalpine variety of this species (*Lobaria linita* var. *linita*). The majority of the known sites are in northwestern Washington, with 36 records in reserve land allocations (USDA, USDI Species Review Panel 1999b and 2000c). *Lobaria linita* var. *tenuoir* occurs in old-growth forests primarily in the Pacific Silver Fir zone, where it grows on lower boles and on moss-covered rocks in interior forest conditions. It is limited and sporadic in its distribution and is often absent in what appears to be suitable habitat (Mt. Baker-Snoqualmie Ecology Program data files and USDA, USDI 2000b). Typically, only a few individuals are present in a local population (USDA, USDI 2000b). *Lobaria linita* is presently thought to have a geographic distribution that is limited within the Northwest Forest Plan area, and is further limited to a small portion of that overall range. The species is considered to have a reference distribution of isolated sites.

*Pseudocyphellaria rainierensis* is endemic to the Pacific Northwest and is known to occur from southeastern Alaska to southern Oregon, west of the Cascade crest (USDA, USDI 2000b). It was one of six species included in the Rare Nitrogen-fixing Lichen group for the FEMAT analysis. Low ratings for this group indicated high concern for this species because of its limited distribution, apparent rarity, and sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Since 1993, the number of known sites has increased from 9 to more than 113, with 98 recent federal sites. About 40 percent of these recent federal sites are in reserve land allocations (USDA, USDI Species Review Panel 2000b). This species is found in cool, humid old-growth conifer forests, from low to mid-elevations west of the Cascade crest. It grows on lower boles and in the lower canopy in interior forest conditions (McCune and Geiser 1997 and USDA, USDI 2000b). It is limited and sporadic in its distribution and is often absent in what appears to be suitable habitat (USDA, USDI Species Review Panel 2000b). Typically, only a few individuals are present in a local population (USDA, USDI 2000b and USDA, USDI Species Review Panel 2000b). This species is still considered rare (McCune and Geiser 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 2000b). Current information suggests that *Pseudocyphellaria rainierensis* is considered to have a widespread geographic range within the Northwest Forest Plan area, but is limited to a small portion of that overall range. The reference distribution for this species is considered to be isolated sites within this geographic range.



Pre-disturbance surveys are considered practical for *Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). These species are conspicuous, have a distinctive growth form, and can be easily located and identified in the field.

### Environmental Consequences and Comparison of Alternatives

Management would be similar for *Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis* under the No-Action Alternative, where these species are in Categories 1, 2, and 3. Under the No-Action Alternative, all current and future known sites would be managed, pre-disturbance surveys and extensive surveys would be required, and high-priority sites would be identified for management.

In general, there is no substantial new information that would change the assumptions of the Northwest Forest Plan and the effects that were predicted (USDA, USDI Species Review Panel 1999b). One exception is the change in original assumptions for *Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis*. These species occur primarily in the oldest stands on the landscape and are rarely found in stands less than 400 years old (USDA, USDI 2000b and Mt. Baker-Snoqualmie Ecology Program data files). If the oldest stands (greater than 200 years) are not selected for management in landscape areas where little late-successional forest exists (USDA, USDI 1994b, p. C-44), this could result in loss of undiscovered populations, and decrease the likelihood of maintaining stable populations distributed in a pattern similar to, or altered from, their reference distribution on federally managed lands within the Northwest Forest Plan area. Under these conditions, the Survey and Manage Standards and Guidelines would become more important for these species. Additionally, as the number of known sites has increased for *Hypogymnia duplicata* and *Lobaria linita* in northwestern Washington, the likelihood of providing stable populations for these species distributed in a pattern similar to, or altered from, their reference distribution on federally managed lands in northwest Washington has increased since the FEMAT analysis (USDA, USDI 2000b and Appendix J2 in USDA, USDI 1994b).

Under Alternatives 1 and 2, these three species are in Category 1A and 2A, respectively. The management direction for Categories 1A and 2A is identical. All current and future known sites would be managed and pre-disturbance surveys would be conducted. Strategic surveys would be conducted to address species information and management needs.

Under Alternative 3, all three species are in Category 3A. Under Category 3A, all current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Management of known sites for these species is required under all alternatives. Under the No-Action Alternative and Alternatives 1 and 2, management would be the same, that is to maintain the species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. Since *Lobaria linita*, *Pseudocyphellaria rainierensis*, and possibly *Hypogymnia duplicata*, are thought to require interior microclimate, site management for these species would be similar under all alternatives. Management of known sites would help maintain the current distribution of populations of these species on federally managed lands.

Pre-disturbance survey requirements would be similar for *Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis* under all alternatives. All alternatives would require pre-disturbance surveys for these species which are likely to discover additional sites that occur in project areas. Sites discovered by these surveys would be managed and contribute to providing for a distribution of populations across the species ranges in the Northwest Forest Plan area.

Strategic surveys would be required under all action alternatives to gather the information needed to manage these species to provide for stable populations distributed in a pattern similar to, or altered from, their reference distribution on federally managed lands within the Northwest Forest Plan area. Strategic surveys would: (1) be effective in providing for species persistence as they can be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; and, (3) narrow the habitat where pre-disturbance surveys would be required. Sites discovered by these surveys would be managed and would contribute to providing a distribution of populations for these species across their range in the Northwest Forest Plan area. Strategic surveys could provide needed information to determine the appropriate management for reducing concerns for *Hypogymnia duplicata*, *Lobaria linita*, and *Pseudocyphellaria rainierensis*.

Regarding *Hypogymnia duplicata*, while there is a moderate level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow *Hypogymnia duplicata* in Northwest Washington to stabilize in a pattern different from its reference distribution. South of this area and throughout the rest of its range in the Northwest Forest Plan area, while there is a high level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow *Hypogymnia duplicata* to stabilize in a pattern different from its reference distribution on federally managed lands within the Northwest Forest Plan area. The high level of uncertainty is because it is known from few sites that are widely separated geographically, populations are typically small, and populations may be vulnerable to stochastic events.

Regarding *Lobaria linita*, while there is a moderate level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow *Lobaria linita* in Northwest Washington to stabilize in a pattern different from its reference distribution. South of this area and throughout the rest of its range in the Northwest Forest Plan area, while there is a high level of uncertainty, all alternatives would provide inadequate habitat (including known sites) to maintain the species. This is because *Lobaria linita* is known from few sites that are widely separated geographically, populations are typically small, and populations may be vulnerable to stochastic events.

There is a high level of uncertainty under all alternatives associated with providing a stable population of *Pseudocyphellaria rainierensis* on federally managed lands within the Northwest Forest Plan area. *Pseudocyphellaria rainierensis* is considered to be a rare species. It generally occurs in older forests (over 400 years old), an age-class that is limited in extent throughout most of the Northwest Forest Plan area because of disturbance history and management actions. The species is widespread but its distribution is limited to a small portion within its range, and is often absent from what appears to be suitable habitat, suggesting possible dispersal limitations. In addition, local populations are generally small and consist of few individuals. In addition, populations may be vulnerable to stochastic events. For these reasons, while there is a high level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow *Pseudocyphellaria rainierensis* to stabilize in a pattern different from its reference distribution on federally managed lands within the Northwest Forest Plan area.

#### ***Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens***

##### **Background and Affected Environment**

*Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* were included in the Riparian Lichen group during the FEMAT analysis. The outcome rating indicated concerns for the Riparian Lichen species with regards to declining air quality, commercial harvesting of special forest products, cumulative effects on nonfederal land, and narrow riparian buffers (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Riparian Reserves were increased between the Northwest Forest Plan Draft SEIS and Final SEIS, so this concern may be reduced somewhat for the riparian species. However, *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* still appear to be rare in the Northwest Forest Plan area based on the number of reported sites (USDA, USDI Species Review Panel 1999b).

*Ramalina thrausta* is reported to occur in boreal North America, south to Oregon, and in western Montana (McCune and Geiser 1997). In the Northwest Forest Plan area it is reported from Oregon and Washington; the number of known sites has increased from 3 to 45 since 1993, with 26 recent federal sites (USDA, USDI Species Review Panel 1999b and 2000b). *Ramalina thrausta* is typically found on bark and branches of trees, primarily conifers, in low to mid-elevation moist forests and riparian areas. This species can be mistaken for the widespread and common lichen, *Alectoria sarmentosa* (McCune and Geiser 1997 and USDA, USDI Species Review Panel 2000b). To date, many of the locations for this species have been reported from mature or old-growth forests (USDA, USDI Species Review Panel 1999b). Pre-disturbance surveys are considered practical for *Ramalina thrausta* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c), although it may be difficult to distinguish from *Alectoria sarmentosa* without close examination. Current information suggests that *Ramalina thrausta* has a moderately widespread geographic range within the Northwest Forest Plan area, and is widespread but spotty within this range. The species biological (reference) distribution is considered to be isolated sites and clusters.

*Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* are poorly known in the Northwest Forest Plan area. Information is limited on their distribution, habitat, and abundance in this region. These species have scattered distributions at northern latitudes (incompletely circumboreal) (Goward et al. 1994). *Leptogium cyanescens* is also reported as cosmopolitan in temperate and subtropical regions (Purvis et al. 1992). These two species are known from a limited number of sites in the Northwest Forest Plan area. *Leptogium burnetiae* var. *hirsutum* is known from only three sites in the Northwest Forest Plan area; one site is known on federally managed land and this has been reported since 1993 (see Table F-2). There are six known sites for *Leptogium cyanescens*; only three are recent sites on federally managed land (see Table F-2). Current information suggests that *Leptogium burnetiae* var. *hirsutum* occurs in a very limited geographic range within the Northwest Forest Plan area, it is limited to a small portion of this range, and it occurs in isolated sites. *Leptogium cyanescens* is thought to occur in a moderately widespread geographic range within the Northwest Forest Plan area, but the distribution within that overall range is unknown due to little available information. Current information suggests the reference distribution is isolated sites.

*Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* may not be closely associated with late-successional or old-growth forests. *Leptogium burnetiae* var. *hirsutum* typically grows on shrubs or trees, but also occurs on decaying logs, mosses, and rock; *Leptogium cyanescens* is typically found on mossy trees, rotten logs, and mossy rocks (McCune and Geiser 1997). Pre-disturbance surveys are considered practical for *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c).

### Environmental Consequences and Comparison of Alternatives

*Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* are in Category 4 under the No-Action Alternative where only general regional surveys would be required.

Management for *Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* is increased under the action alternatives compared to the No-Action Alternative. There is a high concern for *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* because they are known from few sites on federally managed land. Concern is less for *Ramalina thrausta*, yet the number of known sites on federally managed land is still low, especially outside of western Oregon. However, there has been limited survey effort for these three species.

Under Alternatives 1 and 2, these species are in Category 1A and 2A, respectively, which have identical management. All current and future known sites would be managed and pre-disturbance surveys would be conducted. Strategic surveys would be conducted to address species information and management needs.

Under Alternative 3, all three species are in Category 3A under which all current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Management of known sites for *Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* is required under all action alternatives. Under Alternatives 1 and 2, management would be to maintain the species at the site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. Management of known sites would help maintain the current distribution of populations on federally managed lands in the Northwest Forest Plan area. However, since *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* have few known sites on federally managed land, the management of known sites may not increase the likelihood of maintaining stable populations for these two species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. *Ramalina thrausta* has more sites, and a broader distribution, so management of known sites will contribute to providing for this species.

Pre-disturbance surveys are required for these species under the three action alternatives and surveys may discover additional sites if they occur in project areas. Sites discovered by these surveys would be managed and contribute to providing for a distribution of populations across the species ranges in the Northwest Forest Plan area.

*Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* would receive greater protection under the three action alternatives than the No-Action Alternative because of the provision for known site management and pre-disturbance surveys. However, because *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* are known from so few sites, it is unknown how many new sites will be discovered through pre-disturbance surveys.

Strategic surveys would be required under all action alternatives to gather the information needed to manage these species to maintain stable populations across their ranges on federally managed land in the Northwest Forest Plan area. Similar general regional surveys would be conducted under the No-Action Alternative. These surveys under all alternatives would: (1) contribute to providing for species persistence as they could be conducted in areas with high likelihood of locating the species; (2) provide information that could assist in management of the species; and, (3) narrow the habitat where pre-disturbance surveys would be required. These surveys could also address whether *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* are closely associated with late-successional or old-growth forests. Sites discovered by these surveys would be managed and would contribute to providing for populations across the species ranges in the Northwest Forest Plan area. Strategic surveys could provide needed information to determine the appropriate management for reducing concerns for these species.

The action alternatives provide greater management and less uncertainty for *Ramalina thrausta*, *Leptogium burnetiae* var. *hirsutum*, and *Leptogium cyanescens* because of the requirement for known site management and pre-disturbance surveys. Because *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* are considered rare species, and there are few known sites of these two species on federally managed land, there is insufficient information regarding these species to determine how any alternative would affect their distribution and stability.

Regarding *Ramalina thrausta*, while there is a moderate level of uncertainty due to lack of knowledge and potential stochastic events, Alternatives 1, 2, and 3 would provide habitat (including known sites) sufficient to allow species to stabilize in a pattern similar to its reference distribution. This same conclusion applies to the No-Action Alternative, but with a high level of uncertainty. This is because *Ramalina thrausta* occurs primarily at lower elevations and it is unknown at this time how much potential habitat for this species exists on federally managed land.

Also, riparian buffers may provide some protection for known sites of *Ramalina thrausta*, given the reported association of this lichen with riparian vegetation (Appendix J2 in USDA, USDI 1994b), although the extent to which this species occurs in riparian areas is uncertain. Although *Leptogium burnetiae* var. *hirsutum* and *Leptogium cyanescens* were included in the Riparian Lichen group in FEMAT, it is uncertain to what degree these species are associated with riparian areas (USDA, USDI Species Review Panel 1999b and 2000b).

### ***Niebla cephalota* and *Teloschistes flavicans***

#### **Background and Affected Environment**

*Niebla cephalota* and *Teloschistes flavicans* were included in the Rare Oceanic-Influenced Lichen group for the FEMAT analysis. This group of 12 species had the lowest ratings in the lichen analysis, which indicated a high level of concern for these species because of their rarity in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). At the time, they were known only from one or few populations in the Northwest Forest Plan area and had limited distribution. Current information does not change the concerns for these species (USDA et al. 1993; USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b). This group of lichens are still considered rare in the Northwest Forest Plan area and most have low numbers of known sites, low numbers of individuals, limited distributions, and narrow ecological amplitude. Pre-disturbance surveys are considered practical for *Niebla cephalota* and *Teloschistes flavicans* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). *Teloschistes flavicans* is a distinctive species that cannot be mistaken for another lichen species (McCune and Geiser 1997). *Niebla cephalota* may be distinguished in the field upon close examination, but is a rare species and collecting vouchers may be detrimental to its population (McCune and Geiser 1997).

*Niebla cephalota* is a North American coastal endemic that occurs from Baja California to Washington in coastal fog belt areas (McCune et al. 1997). It is a rare species within the Northwest Forest Plan area and is known from few sites with only three on federally managed land (USDA, USDI 2000b; USDA, USDI Species Review Panel 1999b; and McCune and Geiser 1997). *Niebla cephalota* is typically found on exposed, open-grown Sitka spruce (McCune et al. 1997) and occurs on other conifers, shrubs, and rock in open sites on forest edges, windswept headlands, sand dunes, and sparsely forested estuaries and willow swales (USDA, USDI 2000b). At the present time, this species is considered to be closely associated with late-successional or old-growth forests. Current information suggests that the species geographic range is extremely limited within the Northwest Forest Plan area and it occurs within a small portion of this restricted range. The reference distribution is thought to be isolated sites.

*Teloschistes flavicans* is a widespread tropical and subtropical species in the Western Hemisphere, and is found in western North America from Oregon to California within the coastal fog belt. In the Northwest Forest Plan area, it is only known from six locations in a limited geographic area along the immediate Oregon Coast. The ISMS database reports a higher number of pre-FEMAT sites, but this number may include multiple collections from a location (see Table F-2). Only two sites occur on federally managed land and these populations are reported as small. The only substantial population of *Teloschistes flavicans* occurs on nonfederal land (USDA et al. 1993). It is found on exposed headlands and dunes, where it grows in exposed sites on conifers, deciduous trees, and shrubs in coastal forests and shrub thickets (McCune and Geiser 1997 and USDA, USDI 2000b). At the present time, this species is considered to be closely associated with late-successional or old-growth forests. Current information suggests that the species geographic range is extremely limited within the Northwest Forest Plan area and its distribution is limited to a small portion of that restricted range. The reference distribution is thought to be isolated sites.

#### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, *Teloschistes flavicans* and *Niebla cephalota* are in Categories 1 and 3. All current and future known sites would be managed, extensive surveys would be

required, and high-priority sites would be identified for management. Under Alternatives 1 and 2, these two species are in Category 1A and 2A, respectively, which have identical management. All current and future known sites would be managed, pre-disturbance surveys would be conducted, and strategic surveys would be conducted to address species information and management needs.

Under Alternative 3, these two species are in Category 3A. All current and future known sites would be managed with a prescribed 250-meter buffer, pre-disturbance surveys would be conducted prior to habitat-disturbing activities, and strategic surveys would be required to address species information and management needs.

Management of known sites for these two species is required under all alternatives. Under the No-Action Alternative and Alternatives 1 and 2, management would be to maintain the species at the site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. Management of known sites would help maintain the current distribution of populations on federally managed lands. However, since *Teloschistes flavicans* and *Niebla cephalota* have restricted distributions, few known sites, and few sites on federally managed land, the management of known sites would not increase the likelihood of maintaining stable populations of these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area.

Pre-disturbance survey requirements are the same for these species under the action alternatives, but are not required under the No-Action Alternative. *Teloschistes flavicans* and *Niebla cephalota* would receive greater protection under the three action alternatives because of the provision for pre-disturbance surveys. However, because these species are restricted to a small geographic area, occur in specialized habitat, and little habitat occurs on federally managed land, few new populations would likely be discovered. Sites discovered by these surveys would be managed and contribute to providing for the species.

Strategic surveys, and extensive surveys under the No-Action Alternative, would be required under all action alternatives to gather the information needed to manage these species to maintain stable populations distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. These surveys would: (1) be effective in providing for species persistence as they can be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; (3) narrow the habitat where pre-disturbance surveys would be required; and, (4) confirm if these species are closely associated with late-successional or old-growth forests. Sites discovered by these surveys would be managed and would contribute to providing for these species across their ranges in the Northwest Forest Plan area. Strategic surveys could provide needed information to determine the appropriate management for reducing concerns for *Teloschistes flavicans* and *Niebla cephalota*.

The action alternatives provide greater management and less risk for *Teloschistes flavicans* and *Niebla cephalota* because of the requirement for pre-disturbance surveys. Because these species have extremely limited distributions and small populations, and few populations are on federally managed land, there is a high level of uncertainty that all alternatives would provide inadequate habitat (including known sites) to maintain *Teloschistes flavicans* and *Niebla cephalota* on federally managed land in the Northwest Forest Plan area.

### ***Cladonia norvegica***

#### **Background and Affected Environment**

*Cladonia norvegica* was one of six species not rated by the FEMAT lichen panel because of insufficient information (USDA et al. 1993), and outcomes under the different alternatives in the Northwest Forest Plan Final SEIS could not be assessed. This species was included in the Survey and Manage Standards and Guidelines because of persistence concerns since it was thought to be

quite rare (Appendix J2 in USDA, USDI 1994b). Still, little is known about this species' distribution, habitat, or abundance in the Northwest Forest Plan area. In addition, it is uncertain if *Cladonia norvegica* is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

*Cladonia norvegica* is known to occur in western North America from Alaska to Oregon, Great Britain, and Europe. The number of known sites has increased from 1 to 16 since 1993, 12 are recent federal sites (see Table F-2). There are additional undocumented sites in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b). Ten of the 16 sites occur in Late-Successional Reserves (USDA, USDI Species Review Panel 1999b and 2000b). *Cladonia norvegica* is noted as occurring on rotten wood and tree bases (McCune and Geiser 1997). Pre-disturbance surveys are considered not practical for *Cladonia norvegica* (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). It can be difficult to distinguish species in the genus *Cladonia*. The species is difficult to identify in the field; laboratory examination and chemical tests are required (USDA, USDI Species Review Panel 1999b). Due to the very limited information available for this species, the geographic and biological distributions are unknown.

### Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, *Cladonia norvegica* is in Category 3 where extensive surveys would be required to find high-priority sites for management, and to determine appropriate level of management.

*Cladonia norvegica* is in Category 1B under Alternative 1 and Category 2B under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for this species given the difficulty locating and identifying it in the field, and the potential difficulty in accurately identifying specimens even by skilled taxonomists. Strategic surveys would be conducted to address species information and management needs.

Under Alternative 3, this species is in Category 3A. In this category, all current and future known sites would be managed with a prescribed 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Cladonia norvegica* would be required under all alternatives. If all known sites are identified for management under the No-Action Alternative, then management of known sites under the No-Action Alternative would be similar to Alternatives 1 and 2, which is to maintain species at the site. Under Alternative 3, a 250-meter buffer would be prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger, or more stable populations over time. However, if *Cladonia norvegica* is thought to require interior microclimate, there would be little difference between site management under the action alternatives. In all alternatives, management of known sites would help maintain the current distribution of populations.

Under Alternative 3, additional known sites may be discovered and managed as a result of equivalent-effort pre-disturbance surveys. However, because these surveys would be conducted relative to project locations which may not be in the most likely habitat for this species, and because there is difficulty in finding or identifying this species, these surveys may provide only limited additional information. There may be loss of sites under the No-Action Alternative and Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted as they are considered not practical. Considering that *Cladonia norvegica* may be difficult to locate and verify in the field, and current information suggests that the species is rare, the likelihood of losing important sites would be low to moderate.

Strategic surveys would be required under the three action alternatives, and extensive surveys under the No-Action Alternative. These surveys would focus on likely habitats where the species may occur and address questions necessary for the management of *Cladonia norvegica*. Information from these surveys would: (1) provide habitat information to determine if the species is closely associated with late-successional or old-growth forests; (2) help address species management needs to maintain a stable population on federally managed lands within the Northwest Forest Plan area; and, (3) provide information necessary to determine the appropriate management to reduce concerns for this species. In addition, any site found with these surveys would be managed to maintain the species at the site under the three action alternatives, and under the No-Action Alternative if identified as a high-priority site.

Information is limited for *Cladonia norvegica* regarding distribution, abundance, and habitat. There is insufficient information regarding this species to determine how any alternative would affect its distribution and stability.

***Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium***

**Background and Affected Environment**

*Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium* were in the group of pin lichens evaluated during the FEMAT analysis (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b). The Pin Lichen group was rated as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to allow the species to maintain stable, well-distributed populations across federally managed lands within the Northwest Forest Plan area (USDA et al. 1993). This was because the pin lichens were thought to be late-successional or old-growth associated species and little was known about their distribution, ecology, or abundance in the Pacific Northwest (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). There is still limited information on the distribution, ecology, and abundance of these species in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b and 2000b), and uncertainty regarding their association with late-successional or old-growth forests.

These four species of pin lichens have broad global distributions and occur on several continents (Tibell 1975 and Purvis et al. 1992). Most of these species have a broad ecological amplitude and occur in a variety of habitats and stand ages (Tibell 1975; Purvis et al. 1992; and USDA, USDI Species Review Panel 1999b). These lichens are very small, which presents survey difficulties (Appendix J2 in USDA, USDI 1994b). The relatively few records probably reflect the lack of widespread surveys and the small size of these lichens. However, limited survey efforts by taxa experts in the federal agencies and universities have reported new sites since 1993 (USDA, USDI Species Review Panel 1999b). Pre-disturbance surveys are considered not practical for these pin lichens (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). They can be very difficult to locate and identify to species in the field. Detailed microscopic examination is required for species identification (USDA, USDI Species Review Panel 1999b).

*Calicium abietinum* has a wide distribution in the Northwest Forest Plan area, and is reported from Oregon and on both sides of the Cascades in Washington (USDA, USDI Species Review Panel 1999b). The number of known sites for this species in the Northwest Forest Plan area increased from one to nine since 1993, with additional undocumented locations (Appendix J2 in USDA, USDI 1994b and USDA, USDI Species Review Panel 1999b). Only six sites are known on federally managed land. *Calicium abietinum* has been reported from hard snags in open sites or forest gaps (USDA, USDI Species Review Panel 1999b), and occurs on wood of conifers and deciduous trees in Europe (Tibell 1975). It has also been reported from old cedar fence posts (Peterson 2000, pers. comm.). *Calicium abietinum* is still considered to be closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). However, this species is poorly known in the Northwest Forest Plan area and little information is available regarding its distribution, ecology, or abundance.



*Chaenotheca chrysocephala* is more common and widespread than was known during the FEMAT analysis (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b and 2000b). *Chaenotheca chrysocephala* occurs on both sides of the Cascades. The known sites have increased from one to nine, with six recent sites on federally managed land. It has broad ecological amplitude and occurs on bark of conifers. It is uncertain if this species is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

*Chaenotheca ferruginea* has a wide distribution, although reported from limited sites in the Northwest Forest Plan area of Oregon and Washington. It was suspected to occur in 1993 and is now known from 12 sites; 9 are recent sites on federally managed land (Appendix J2 in USDA, USDI 1994b) (see Table F-2). It occurs mostly at lower elevations, on the bark of conifers and deciduous trees. It is uncertain if this species is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

*Microcalicium arenarium* is only documented from one site in the Northwest Forest Plan area (see Table F-2). Two additional sites are reported but not documented (USDA, USDI Species Review Panel 1999b). It has been found on rocks in the Columbia River Gorge. There is limited information for this species and there is uncertainty if it is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b and 2000b).

Current information suggests that *Calicium abietinum*, *Chaenotheca chrysocephala*, and *Chaenotheca ferruginea* have widespread geographic ranges within the Northwest Forest Plan area, have a limited distribution throughout this range, and occur in isolated sites. The geographic and biological distribution pattern of *Microcalicium arenarium* in the Northwest Forest Plan area is unknown.

### Environmental Consequences and Comparison of Alternatives

*Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium* are in Category 4 under the No-Action Alternative where general regional surveys would be required. These species are in Category 1B under Alternative 1 and Category 2B under Alternative 2. The management direction for these categories would be identical. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for these species, given their very small size, the difficulty locating and identifying them in the field, and the potential difficulty in accurately identifying specimens even by skilled taxonomists. Strategic surveys would be conducted to address species information and management needs.

Under Alternative 3, these species are in Category 3A. In this category, all current and future known sites would be managed with a prescribed 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium* would be required under the three action alternatives. Management of known sites under Alternatives 1 and 2 would be the same in that management would be to maintain species persistence at the site. Under Alternative 3, a 250-meter buffer would be prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. However, if the species is thought to require interior microclimate, there would be little difference between site management under the action alternatives. Based on current information, these species have limited distributions, so management of known sites may not increase the likelihood of maintaining stable populations for these species in the Northwest Forest Plan area. There would be no requirement to manage known sites under the No-Action Alternative. Current information suggests these species are rare and all sites would be important to provide for the species.

Equivalent-effort surveys prior to habitat-disturbing activities are required for *Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium* under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. However, because these surveys would be conducted relative to project locations as opposed to the most likely habitat, and because there is difficulty in finding or identifying these species, these surveys may provide only limited additional information for management. There may be some loss of sites under the No-Action Alternative and Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted. Since current information suggests these species are rare on the landscape, the likelihood of losing important sites would probably be low to moderate.

Strategic surveys would be required under all action alternatives to gather the information needed to manage these species to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Similar general regional surveys are required under the No-Action Alternative. These surveys would address questions for management and focus on likely sites where the species may occur. Strategic surveys may locate additional sites for the species. Information from these surveys would: (1) provide habitat information to determine if these species are closely associated with late-successional or old-growth forests; (2) help address species management needs to maintain these species in the Northwest Forest Plan area; and, (3) provide information necessary to determine the appropriate management to reduce concerns for these species. In addition, any site found with these surveys would be managed to maintain the species at the site under the three action alternatives.

*Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium* would receive greater protection under the three action alternatives than the No-Action Alternative. The action alternatives provide management of all known sites and strategic surveys; Alternative 3 includes equivalent-effort surveys. Under the No-Action Alternative, these species would receive general regional surveys with no site management. The concern for these species is lower under the action alternatives compared to the No-Action Alternative, primarily because of the requirement for known site management, and concern is lowest under Alternative 3 because of pre-disturbance surveys.

Information is limited on distribution, abundance, and habitat associations for *Calicium abietinum*, *Chaenotheca chrysocephala*, *Chaenotheca ferruginea*, and *Microcalicium arenarium*. Because so little is known, there is insufficient information to determine how any alternative would affect the distribution and stability of these species.

***Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina***

### **Background and Affected Environment**

*Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1 (previously referred to as *Pseudocyphellaria mougeotiana*), and *Usnea hesperina* were included in the Rare Oceanic-Influenced Lichen group in the FEMAT analysis. The Rare Oceanic group had the lowest rating in the lichen analysis. This rating indicated a high level of concern for these species because of their rarity in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). At the time they were known only from one or few populations in the Northwest Forest Plan area and had limited distribution. In the Pacific Northwest, they occur along the immediate coast from central Oregon south into California, and the populations are typically disjunct and isolated. Current information still indicates these lichens are rare in the Northwest Forest Plan area, and most have a low number of known sites, low numbers of individuals, limited distribution, and narrow ecological amplitude. At the present time, these species are considered to be closely associated with late-successional or old-growth forests.

Pre-disturbance surveys are considered not practical for these species (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). *Bryoria* and *Usnea* are difficult genera to work with and species identification often requires a high level of expertise. It may also be difficult to locate and distinguish these species in the field. Microscopic examination and chemical tests are often required to verify species identification. *Pseudocyphellaria* sp. #1 is considered not practical to survey for because of the current taxonomic uncertainty with this species, and it is also rare (USDA, USDI 2000b). All five species are considered rare in the Northwest Forest Plan area and collection of voucher specimens for species verification may harm local populations.

*Bryoria pseudocapillaris* and *Bryoria spiralifera* are western North American endemics that occur on the coast from California to central Oregon (USDA, USDI 2000b and Appendix J2 in USDA, USDI 1994b). *Bryoria pseudocapillaris* was known only from two locations in 1993 (Appendix J2 in USDA, USDI 1994b). This species is now known from seven populations along the immediate coast. Only two of these locations are on federally managed land (USDA, USDI 2000b). *Bryoria spiralifera* was known only from one location in 1993 (Appendix J2 in USDA, USDI 1994b) and is now known from seven populations along the immediate coast. Only three of these locations are on federally managed land; two are recent federal sites (see Table F-2). These species are found on exposed trees (Sitka spruce and shore pine) and shrubs on coastal windswept dunes and rocky headlands within 1.8 miles (3 kilometers) of the ocean (USDA, USDI 2000b).

*Bryoria subcana* has been found from Alaska to California, usually within 30 miles of the coast, and also in Great Britain. This species is now known from five locations along the coast within the Northwest Forest Plan area, with three sites on federally managed land (USDA, USDI 2000b). This number of sites on federally managed land is lower than reported in Table F-2. Most of the recent federal sites reported in Table F-2 were from the Cascades, and there is uncertainty with the identification of these collections, as current information indicates that *Bryoria subcana* is strictly a coastal species (USDA, USDI Species Review Panel 1999b and 2000b). *Bryoria subcana* occurs on bark and wood of conifers in forests of coastal bays and streams, to high precipitation ridges and summits in late-successional or old-growth forests, and conifer and mixed conifer-deciduous forests (USDA, USDI 2000b).

*Pseudocyphellaria* sp. #1 is restricted in its distribution. This taxon is known from only three locations within a small area along the Oregon Coast, and only one of these locations is known to be on federally managed land (USDA, USDI 2000b). There is currently taxonomic uncertainty with this taxon as some lichenologists consider it to be a variant of *Pseudocyphellaria crocata* (Goward et al. 1994 and McCune and Geiser 1997). The taxonomic issues still need to be resolved. *Pseudocyphellaria* sp. #1 has been found in conifer litter in a riparian old-growth Sitka spruce, Douglas-fir, and western hemlock forest on the immediate coast, and on shaded branches of bristly manzanita in a shrub community on stabilized sand dunes (USDA, USDI 2000b).

*Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, and *Pseudocyphellaria* sp. #1 (previously referred to as *Pseudocyphellaria mougeotiana*) all have similar distribution patterns. Current information suggests that they are extremely limited geographically in the Northwest Forest Plan area, their distribution within this area is limited to a small portion of their ranges, and they occur in isolated sites.

*Usnea hesperina* has a broad global distribution and is found in western North America from British Columbia to Oregon within the coastal fog belt (McCune et al. 1997). It was known from only 1 site in 1993 (Appendix J2 in USDA, USDI 1994b), and is now known from 10 locations along the coast in the Northwest Forest Plan area. Seven of these locations are on federally managed lands (see Table F-2). In Oregon, this species occurs in exposed sites on conifers, hardwoods, and shrubs on windswept headlands and dunes (USDA, USDI 2000b). Current information suggests that *Usnea hesperina* is extremely limited geographically in the Northwest Forest Plan area, its distribution is limited to a small portion within this range, and it occurs in isolated sites or isolated site clusters.

## Environmental Consequences and Comparison of Alternatives

There is no substantial new information that would change the assumptions of the Northwest Forest Plan and the effects that were predicted (USDA, USDI Species Review Panel 1999b) for *Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina*.

Management would be similar for these five species under the No-Action Alternative, where they are in Categories 1 and 3. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

These species are in Category 1B under Alternative 1 and Category 2B under Alternative 2. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for these species, given the difficulty locating and identifying them in the field. There is a potential difficulty in accurately identifying specimens even by skilled taxonomists because of taxonomic uncertainty surrounding *Pseudocyphellaria* sp. #1, and it is difficult to distinguish closely related species in the genera *Bryoria* and *Usnea*. Strategic surveys would be required and conducted to address species information and management needs.

These species are in Category 3A under Alternative 3. All current and future known sites would be managed with a 250-meter buffer. Pre-disturbance surveys would be conducted, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina* is required under all alternatives. Under the No-Action Alternative and Alternatives 1 and 2, management would be to maintain species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. Management of known sites would help maintain the current distribution of populations on federally managed lands. However, since these species have restricted distributions, few known sites, and few sites on federally managed land, the management of known sites would not increase the likelihood of maintaining stable populations for these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for these five species under Alternative 3. *Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina* receive greater management under Alternative 3 compared to the other alternatives because of this requirement for pre-disturbance surveys. However, because these species are restricted in their geographic distribution, occur in specialized habitat, and little habitat occurs on federally managed land, only a few new populations would likely be discovered. Sites discovered by these surveys would be managed and contribute to providing a distribution of populations across the species ranges in the Northwest Forest Plan area. There would be some loss of sites under Alternatives 1 and 2 and the No-Action Alternative because surveys prior to habitat-disturbing activities would not be conducted. There is a concern that this potential loss of sites could eliminate populations that are important to provide for these species.

Strategic surveys would be required under all action alternatives to gather the information needed to manage these species to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Similar extensive surveys would be required under the No-Action Alternative. Sites discovered by these surveys would be managed and would contribute to providing for the species. These surveys would: (1) contribute to providing information on the species as they could be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; and, (3) confirm if these species

are closely associated with late-successional or old-growth forests. Strategic surveys could also provide needed information to determine the appropriate management for reducing concerns for *Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina* in the Northwest Forest Plan area.

Alternative 3 provides greater management than the other alternatives for *Bryoria pseudocapillaris*, *Bryoria spiralifera*, *Bryoria subcana*, *Pseudocyphellaria* sp. #1, and *Usnea hesperina* because of the requirement for pre-disturbance surveys. There is a slight increase in the concern for these species under the No-Action Alternative and Alternatives 1 and 2 because there are no pre-disturbance surveys. While there is a high level of uncertainty, due to limited distribution and limited populations, few populations on federally managed land, limited potential suitable habitat on federally managed land, and the potential for stochastic events, all alternatives would provide inadequate habitat (including known sites) to maintain these species. For *Pseudocyphellaria* sp. #1, there is insufficient information to determine how any alternative would affect its distribution and stability.

### ***Nephroma occultum* and *Dendroica intricatulum***

#### **Background and Affected Environment**

*Nephroma occultum* and *Dendroica intricatulum* were included in the Rare Nitrogen-fixing group for the FEMAT analysis. The low outcome ratings reflected high concerns for this group and were based on the limited distribution, low number of sites, narrow ecological amplitude, and sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b).

Pre-disturbance surveys are considered not practical for these species (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). *Nephroma occultum* is a canopy lichen and is rarely and unpredictably found in litterfall on the forest floor, making it difficult to confidently determine its presence in a stand. *Dendroica intricatulum* is a cryptic lichen and may be difficult to locate; it has the potential to be overlooked because of its small size.

*Nephroma occultum* is a western North American endemic occurring from British Columbia to southern Oregon (USDA, USDI 2000b). Since 1993, the number of sites reported for this species in the Northwest Forest Plan area has increased from 21 to about 100, with 74 recent sites on federally managed land (USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b and 2000b). It occurs as a canopy lichen in older, moist conifer forests, from low to mid-elevation on the west slope of the Cascades in Oregon and Washington (USDA, USDI 2000b and McCune and Geiser 1997). Populations are sporadically distributed in the region, with most known sites in the central Oregon Cascades (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b). Almost all sites are on federally managed land; about 30 percent occur in reserve land allocations (USDA, USDI Species Review Panel 2000b). *Nephroma occultum* occurs on large, old, lateral limbs of conifers, and is rarely found on the forest floor as litterfall. Current information suggests that *Nephroma occultum* has a moderate geographic range within the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated sites or isolated site clusters.

*Dendroica intricatulum* is a Pacific Northwest endemic ranging from southeast Alaska to northern California (USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites for this taxon in the Northwest Forest Plan area has increased from 1 to 72, with 66 recent sites on federally managed land (USDA, USDI 2000b; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b and 2000b). The majority of recent sites are reported from southern Oregon (USDA, USDI Species Review Panel 1999b and 2000b). The taxonomy of *Dendroica intricatulum* is being revised (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b).

*Dendroica intricatulum* has been found in a variety of habitats, including open conifer and deciduous stands, oak woodlands, oak balds, and moist conifer forests at low to mid-elevation in

the western Cascades. Most known sites in Washington and Oregon are on federally managed land, although few sites are in reserve land allocations (USDA, USDI Species Review Panel 2000b). The lichen thallus is quite small and difficult to detect (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b). Current information suggests that *Dendroscocaulon intricatum* has a moderate geographic range within the Northwest Forest Plan area, its distribution is widespread but spotty within this range, and it occurs in isolated site clusters.

### Environmental Consequences and Comparison of Alternatives

In general, there is no substantial new information for *Nephroma occulta* and *Dendroscocaulon intricatum*, except as noted below, that would change the assumptions of the Northwest Forest Plan and the effects that were predicted (USDA, USDI Species Review Panel 1999b). *Dendroscocaulon intricatum* is currently known from more sites and across a broader habitat range than during the FEMAT analysis, so the concern for this species may be lower than in 1993. *Nephroma occulta* has a number of new sites reported since 1993. This species is still considered rare in the Northwest Forest Plan area. *Nephroma occulta* occurs primarily in the oldest stands on the landscape and is rarely found in stands less than 400 years old (USDA, USDI 2000b). In the FEMAT analysis, *Nephroma occulta* and *Dendroscocaulon intricatum* were anticipated to benefit from the management of old-growth stands in landscape areas where little late-successional forest exists (USDA, USDI 1994b, p. C-44). If the oldest stands (greater than 200 years) are not selected for protection in landscape areas where little late-successional forest exists, this could result in loss of undiscovered sites and decrease the likelihood of maintaining stable populations of these species distributed in a pattern similar, to or altered from, their reference distribution on federally managed lands within the Northwest Forest Plan area. Under these conditions, the Survey and Manage Standards and Guidelines would become more important for these species.

Management would be similar for *Nephroma occulta* and *Dendroscocaulon intricatum* under the No-Action Alternative, where they are in Categories 1 and 3. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

*Nephroma occulta* and *Dendroscocaulon intricatum* are in Category 1B under Alternative 1 and Category 2B under Alternative 2. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for these species, given the difficulty locating them in the field. *Dendroscocaulon intricatum* may be easily overlooked because of its small size; *Nephroma occulta* is a canopy lichen, occurring rarely and unpredictably in litterfall on the forest floor.

*Nephroma occulta* and *Dendroscocaulon intricatum* are in Category 3A under Alternative 3. All current and future known sites would be managed with a 250-meter buffer. Pre-disturbance surveys would be conducted, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Nephroma occulta* and *Dendroscocaulon intricatum* is required under all alternatives. Under the No-Action Alternative and Alternatives 1 and 2, management would be to maintain the species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. Since *Nephroma occulta* and *Dendroscocaulon intricatum* may require interior microclimate, site management for these species would be similar under all alternatives. Management of known sites would help maintain the current distribution of populations of these species on federally managed lands.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for *Nephroma occulta* and *Dendroscocaulon intricatum* under Alternative 3. Additional known sites may be

discovered and managed as a result of these pre-disturbance surveys. Because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, and given the difficulty in finding these species, it is uncertain how many additional sites will be found. There may be some loss of sites under Alternatives 1 and 2 and the No-Action Alternative because surveys prior to habitat-disturbing activities would not be conducted. The concern is that a potential loss of sites could eliminate populations that are important to provide for stable populations of these species distributed in a pattern similar to, or altered from, their reference distribution on federally managed lands within the Northwest Forest Plan area.

Strategic surveys would be required under all action alternatives to gather the information needed to manage these species to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Similar extensive surveys would be required under the No-Action Alternative. These surveys would contribute to providing for the species as they can be conducted in areas with high likelihood of locating the species and provide information that can assist in management. Sites discovered by these surveys would be managed and would contribute to providing a distribution of populations across the species ranges in the Northwest Forest Plan area. Strategic surveys could also provide needed information to determine the appropriate management for reducing concerns for *Nephroma occultum* and *Dendroica caerulea intricatulum*.

Alternative 3 provides greater management than the other alternatives for *Nephroma occultum* and *Dendroica caerulea intricatulum* because of the requirement for pre-disturbance surveys. There is an increase in concern for these species under the No-Action Alternative and Alternatives 1 and 2 because there are no pre-disturbance surveys. The inadvertent loss of sites under the No-Action Alternative and Alternatives 1 and 2 may increase instability of these species. Sites may be lost that are important to provide for stable populations on federally managed lands within the Northwest Forest Plan area. The No-Action Alternative and Alternatives 1 and 2 are similar in providing management for these species compared to Alternative 3.

In conclusion, *Nephroma occultum* is considered a rare species. It generally occurs in older forests (over 400 years old), an age-class that is limited in extent throughout most of the Northwest Forest Plan area because of disturbance history and management actions. It is unknown if our current knowledge of *Nephroma occultum* and *Dendroica caerulea intricatulum* represents their true rarity, given the difficulty with surveying for them, and because of limited survey efforts to date. While there is a high level of uncertainty, all alternatives would provide habitat (including known sites) sufficient to allow this species to stabilize in a pattern different from its reference distribution.

There is less concern for *Dendroica caerulea intricatulum* because of the number of new sites that have been found, although these sites have been concentrated in a small geographic area, and because this species has a broader ecological amplitude than previously known. While there is a moderate level of uncertainty, all alternatives would provide sufficient habitat (including known sites) to allow this species to stabilize in a pattern similar to its reference distribution.

### ***Dermatocarpon luridum* and *Leptogium rivale***

#### **Background and Affected Environment**

*Dermatocarpon luridum* and *Leptogium rivale* were included in the Aquatic Lichen group for the FEMAT analysis. Low ratings for this group during the FEMAT analysis were based on their rarity, limited distribution, and sensitivity to declines in water quality (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Because habitat data is limited on adjacent riparian vegetation, it is uncertain if these two species are closely associated with late-successional or old-growth forests (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b).

*Dermatocarpon luridum* is an aquatic lichen with a broad global distribution (USDA, USDI 2000b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased to 13, with 6 recent federal sites (USDA, USDI 2000b and Appendix J2 in USDA, USDI 1994b). There are additional undocumented locations (USDA, USDI Species Review Panel 1999b).

*Dermatocarpon luridum* grows on rock in or alongside lakes, small streams, and rivers, across a broad elevational range from 1,000 to 6,500 feet (McCune and Geiser 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). Adjacent vegetation varies, and may be deciduous or conifer forests of various ages, or subalpine meadows. The current distribution of known sites is widely scattered in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b and 2000b). About half of the known sites are on federally managed land and all federal sites are located in Riparian Reserves (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b).

*Leptogium rivale* is endemic to western North America. Since 1993, the number of known sites for *Leptogium rivale* in the Northwest Forest Plan area has increased from 2 to 37 in Washington and Oregon, with 28 recent federal sites and additional undocumented locations (Appendix J2 in USDA, USDI 1994b and USDA, USDI Species Review Panel 1999b and 2000b). *Leptogium rivale* is an aquatic species growing on rock in small, clear, cold streams and springs from 500 to 6,500 feet in elevation (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Most known sites are on federally managed land and all federal sites occur within Riparian Reserves.

These two species have similar distribution patterns. Current information suggests that both are widespread geographically in the Northwest Forest Plan area, although are limited in distribution across this range, and they occur in isolated sites. Pre-disturbance surveys are considered not practical for these species. They may be difficult to detect in streams and difficult to identify to species (USDA, USDI Species Review Panel 1999b and 2000c).

### **Environmental Consequences and Comparison of Alternatives**

There is new information for *Dermatocarpon luridum* and *Leptogium rivale* that may change some of the assumptions of the Northwest Forest Plan and the effects that were predicted (USDA et al. 1993; USDA, USDI 1994a; and USDA, USDI Species Review Panel 1999b and 2000b). *Dermatocarpon luridum* and *Leptogium rivale* are aquatic lichen species. Between the Northwest Forest Plan Draft SEIS and Final SEIS, the width of the riparian reserves was increased. Therefore, *Leptogium rivale* and *Dermatocarpon luridum* received additional protection from the Aquatic Conservation Strategy. Because of this change in riparian protection, concerns for these species may be lower than during the previous analysis. The number of known sites have also increased for these species (particularly for *Leptogium rivale*), and the known range for *Leptogium rivale* now extends into southern Oregon (USDA, USDI Species Review Panel 2000b). Information is still limited for *Dermatocarpon luridum* and *Leptogium rivale* regarding distribution, abundance, habitat, and degree of rarity.

Management would be similar for *Dermatocarpon luridum* and *Leptogium rivale* under the No-Action Alternative, where they are in Categories 1 and 3. Under the No-Action Alternative, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be identified for management.

*Dermatocarpon luridum* and *Leptogium rivale* are in Category 1B under Alternative 1 and Category 2B under Alternative 2. All current and future known sites would be managed. Pre-disturbance surveys are considered not practical for these species; they may be difficult to detect in streams and difficult to identify to species.

*Dermatocarpon luridum* and *Leptogium rivale* are in Category 3A under Alternative 3. All current and future known sites would be managed with a 250-meter buffer. Pre-disturbance surveys would be conducted, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Dermatocarpon luridum* and *Leptogium rivale* is required under all alternatives. Under the No-Action Alternative and Alternatives 1 and 2, management would be



to maintain the species at the site. Under Alternative 3, a 250-meter buffer is prescribed for each known site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. Management of known sites would help maintain the current distribution of populations of these species on federally managed lands. However, given the current spotty distribution of these species, and few known sites (especially for *Dermatocarpon luridum*), management of known sites alone may not increase the likelihood of maintaining stable populations for these species across their range on federally managed lands within the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for *Dermatocarpon luridum* and *Leptogium rivale* under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. Because these surveys would be conducted relative to project locations, which may not be in the most likely habitat, and given the difficulty in detecting these species in streams, it is uncertain how many additional sites will be discovered with these surveys. As aquatic species, these lichens receive management under the Aquatic Conservation Strategy, so there would be a low risk of loss of sites under Alternatives 1 and 2 and the No-Action Alternative, where surveys prior to habitat-disturbing activities would not be conducted. The concern is also low that this potential loss of sites could eliminate populations that are important to provide for the species because of management under the Aquatic Conservation Strategy.

Strategic surveys would be required under all action alternatives to gather the information needed to manage *Dermatocarpon luridum* and *Leptogium rivale* to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Similar extensive surveys would be required under the No-Action Alternative. These surveys would: (1) contribute to providing for the species as they can be conducted in areas with high likelihood of locating the species; (2) provide information that can assist in management of the species; and, (3) determine if these aquatic lichens are closely associated with late-successional or old-growth forests. Sites discovered by these surveys would be managed and would contribute to providing a distribution of populations across the species ranges in the Northwest Forest Plan area. Strategic surveys could also provide needed information to determine the appropriate management for reducing concerns for *Dermatocarpon luridum* and *Leptogium rivale*.

Alternative 3 provides greater management for *Dermatocarpon luridum* and *Leptogium rivale* than the other alternatives because of the requirement for pre-disturbance surveys. There is a slight increase in concern for these species under the No-Action Alternative and Alternatives 1 and 2 because there are no pre-disturbance surveys. However, the management for these aquatic lichen species is likely similar under all alternatives because of the provisions of the Aquatic Conservation Strategy.

While there is a moderate level of uncertainty due to rarity of the species and lack of knowledge, all alternatives would provide sufficient habitat (including known sites) to allow both *Dermatocarpon luridum* and *Leptogium rivale* to stabilize in a pattern similar to their reference distribution. However, concern for these aquatic lichen species is not high because of the provisions for riparian areas in the Aquatic Conservation Strategy.

### ***Platismatia lacunosa***

#### **Background and Affected Environment**

*Platismatia lacunosa* was included in the Riparian Lichen group during the FEMAT analysis. The outcome rating for the riparian group of nine species indicated concerns with regards to declining air quality, commercial harvesting as a special forest product, cumulative effects on nonfederal land, and narrow riparian buffers (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). However, Riparian Reserves were increased between the Northwest Forest Plan Draft SEIS and Final SEIS, so this concern may be reduced somewhat for the riparian species.

*Platismatia lacunosa* is known from Alaska to California (McCune and Geiser 1997). Since 1993, the number of known sites in the Northwest Forest Plan area has increased from 9 to 55, with 42 recent federal sites (USDA, USDI Species Review Panel 1999b and 2000b and Appendix J2 in USDA, USDI 1994b). *Platismatia lacunosa* has been found on bark and wood from mainly deciduous trees (especially alder) and occasionally on mossy rock (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b) from the coast to the Cascades. It appears to occur in a wide range of habitats, from mid to late-seral conditions in moist riparian forests and cool upland sites (McCune and Geiser 1997). Current information suggests that *Platismatia lacunosa* has a widespread geographic range within the Northwest Forest Plan area, is widespread but spotty within its range, and occurs in isolated site clusters. This species is currently considered to be closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b). Pre-disturbance surveys are considered practical for this species (USDA, USDI Species Review Panel 1999b and 2000c).

### **Environmental Consequences and Comparison of Alternatives**

*Platismatia lacunosa* is in Category 4 under the No-Action Alternative where general regional surveys would be required.

Under Alternative 1, *Platismatia lacunosa* is in Category 1C. Under this category, all current and future known sites would be managed until high-priority sites can be determined. Pre-disturbance surveys would be conducted to minimize inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Under Alternative 2, *Platismatia lacunosa* is in Category 2D. Under this Alternative, all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed in 5 years. Pre-disturbance surveys are not required.

Under Alternative 3, *Platismatia lacunosa* is in Category 3B. This category would require management of all current and future known sites until high-priority sites can be determined. Equivalent-effort pre-disturbance surveys would be required to minimize inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

*Platismatia lacunosa* would receive greater protection under the action alternatives than under the No-Action Alternative, where there is no requirement for known site management. Alternatives 1 and 3 would provide the most protection for *Platismatia lacunosa*. Known site management varies in the action alternatives. Under Alternatives 1 and 3 only high-priority sites would be managed. The Management Recommendations for *Platismatia lacunosa* would identify the high-priority sites, but until these documents are approved, all known sites would be managed. Sites that are not considered necessary for species persistence may be lost under Alternatives 1 and 3. The concern for this species would be increased under the No-Action Alternative because there is no site management and sites may be lost that could be important in providing for a stable population.

The least amount of site protection in the action alternatives occurs under Alternative 2, where only sites known as of September 30, 1999, would be managed. This could result in loss of sites that may be important for maintaining this species in stable populations on federally managed lands within the Northwest Forest Plan area. After 5 years, following completion of strategic surveys, this species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. The current known sites have a spotty distribution due, in part, to uneven survey effort. Therefore, limiting management of known sites to current levels may leave substantial gaps in its distribution. Failure to manage for new sites located in these gaps would increase the concern that Alternative 2 would not provide for a stable population distributed in a pattern similar to, or altered from, its reference distribution on federally managed lands within the Northwest Forest Plan area.

Pre-disturbance surveys would be required for *Platismatia lacunosa* under Alternatives 1 and 3. Sites that are discovered would be managed to provide for the species if they are identified as high-priority sites. The absence of pre-disturbance surveys in the other alternatives increases the concern if loss of sites occurs within a portion of its range where additional populations are necessary to provide for its distribution and abundance. However, due to the habitat managed in the reserves, particularly Riparian Reserves, the risk of losing important sites would likely be low.

Strategic surveys would be required under all action alternatives to gather the information needed to manage *Platismatia lacunosa* to maintain stable populations on federally managed lands within the Northwest Forest Plan area. These surveys would be completed in 5 years in Alternative 2. Similar general regional surveys are required under the No-Action Alternative. Strategic surveys would: (1) determine what the level of concern is for *Platismatia lacunosa* throughout its range; (2) determine if the reserve land allocations provide for the species; (3) determine what the appropriate management is in order to maintain a stable population on federally managed lands within the Northwest Forest Plan area; and, (4) confirm if it is closely associated with late-successional or old-growth forests.

Alternatives 1 and 3 are similar in management of *Platismatia lacunosa*. These alternatives provide greater management because of the requirement for known site management and pre-disturbance surveys. There is a higher concern for maintaining a stable population under Alternative 2 because only sites known as of September 30, 1999, are managed. The No-Action Alternative creates the greatest concern for this species because there is no site management. While there is a moderate level of uncertainty because the species occurs primarily at lower elevations and it is unknown at this time how much potential habitat exists on federally managed land, Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution. While there is a high level of uncertainty, the No-Action Alternative and Alternative 2 would provide sufficient habitat (including known sites) to allow species to stabilize in a pattern similar to its reference distribution. Riparian buffers may provide some protection of known sites under these alternatives, given the reported association of this lichen with riparian vegetation (Appendix J2 in USDA, USDI 1994b), although the extent to which this species occurs in riparian areas is uncertain. Other reserve land allocations may also provide some protection of known sites.

***Heterodermia sitchensis*, *Hypogymnia vittata*, *Hypotrachyna revoluta*, *Nephroma isidiosum*, and *Ramalina pollinari***

**Background and Affected Environment**

These five species were not rated by the FEMAT lichen panel because of insufficient information (USDA et al. 1993), and outcomes under the different alternatives in the Northwest Forest Plan SEIS could not be assessed. They were included in the Survey and Manage Standards and Guidelines because of persistence concerns since they were thought to be rare (Appendix J2 in USDA, USDI 1994b). Little is known about these species and their status is undetermined. Little is known about these species' distribution, habitat, or abundance in the Northwest Forest Plan area. In addition, it is uncertain if these species are closely associated with late-successional or old-growth forests.

*Heterodermia sitchensis*, *Hypogymnia vittata*, and *Nephroma isidiosum* have not been documented in the Northwest Forest Plan area. These species are known to occur in British Columbia, and it is suspected that suitable habitat may exist in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b and 2000b). *Hypotrachyna revoluta* has a broad global distribution, and is reported to occur in western North America from coastal Alaska to California (Purvis et al. 1992 and McCune and Geiser 1997). There is only one known site for this species in the Northwest Forest Plan area and it occurs on federally managed land (USDA, USDI Species Review Panel 1999b and 2000b). The geographic and biological distribution patterns of these four lichens is unknown.

*Ramalina pollinaria* is reported to occur in western North America from the Cascades to the Rockies (McCune and Geiser 1997), and along the coast in California and Oregon (USDA, USDI Species Review Panel 1999b). It also occurs in Great Britain, Europe, and Scandinavia (Purvis et al. 1992). There are 12 known sites for this species in the Northwest Forest Plan area, most on nonfederal land (see Table F-2). Two sites are reported from federally managed land, one since 1993. In the Pacific Northwest, this species is reported to occur on bark and wood, often in low elevation swamps with spruce (McCune and Geiser 1997). Current information suggests that *Ramalina pollinaria* has a limited geographic range within the Northwest Forest Plan area, its distribution is limited to a small portion within this range, and it occurs in isolated sites.

### Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, *Heterodermia sitchensis*, *Hypogymnia vittata*, *Hypotrachyna revoluta*, *Nephroma isidiosum*, and *Ramalina pollinaria* are in Category 3 where extensive surveys would be required to find high-priority sites for management and to determine the appropriate level of management.

The status of these species is undetermined under the three action alternatives because it is uncertain if they meet the three basic criteria to be included in the Survey and Manage Standards and Guidelines. It is unknown if these five species are closely associated with late-successional or old-growth forests. *Heterodermia sitchensis*, *Hypogymnia vittata*, and *Nephroma isidiosum* have not been documented in the Northwest Forest Plan area.

*Heterodermia sitchensis*, *Hypogymnia vittata*, *Hypotrachyna revoluta*, *Nephroma isidiosum*, and *Ramalina pollinaria* are in Category 1E under Alternative 1 and Category 2C under Alternative 2. The management is identical under Alternatives 1 and 2, where strategic surveys would be conducted to determine if these species meet the basic criteria for Survey and Manage. All current and future known sites would be managed until strategic surveys can determine if the species meets the basic criteria for Survey and Manage. Alternative 3 provides the greatest protection for these species. In Alternative 3, these species are in Category 3A, where all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for these species would be required under all action alternatives. Management of known sites under Alternatives 1 and 2 is to maintain the species at the site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. However, if these species are thought to require interior microclimate, there would be little difference between site management under the action alternatives. Based on current information, these species have limited distribution in the Northwest Forest Plan area, and may not occur in this region at all, so management of known sites may not increase the likelihood of maintaining stable populations for these species. In all action alternatives, management of known sites would help maintain the current distribution of populations.

Equivalent-effort surveys prior to habitat-disturbing activities are required for these species under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. Because these surveys would be conducted relative to project locations which may not be in the most likely habitat for these species, and because these species are known from few sites, or not known to occur in the Northwest Forest Plan area, these surveys may provide only limited additional information. There may be some loss of sites under the No-Action Alternative and Alternatives 1 and 2 because surveys prior to habitat-disturbing activities would not be conducted. Current information suggests these species are rare in the Northwest Forest Plan area, so the possibility of losing important sites is probably low.

Strategic surveys would be required under the three action alternatives, and extensive surveys under the No-Action Alternative. These surveys would focus on likely habitats where these species may occur, and address questions necessary for the management of these species. Information from these surveys would: (1) help determine if the species occur in the Northwest Forest Plan area; (2) provide habitat information to determine if the species are closely associated with late-successional or old-growth forests; and, (3) help address species management needs to maintain stable populations on federally managed lands within the Northwest Forest Plan area. In addition, any site found with these surveys would be managed to maintain the species at the site under the three action alternatives, and under the No-Action Alternative if identified as a high-priority site.

Information regarding distribution, abundance, and habitat, is limited for *Heterodermia sitchensis*, *Hypogymnia vittata*, *Hypotrachyna revoluta*, *Nephroma isidiosum*, and *Ramalina pollinaria*. There is insufficient information regarding these species to determine how any alternative would affect their distribution and stability.

### ***Calicium adpersum*, *Chaenotheca subroscida*, *Chaenothecopsis pusilla*, and *Stenocybe clavata***

#### **Background and Affected Environment**

*Calicium adpersum*, *Chaenotheca subroscida*, *Chaenothecopsis pusilla*, and *Stenocybe clavata* were included in the Pin Lichen Group for the FEMAT analysis. The pin lichens were rated as having a low likelihood of having habitat of sufficient quality, distribution, and abundance to provide for stable, well-distributed populations across federally managed lands within the Northwest Forest Plan area, in part because so little was known about these species (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). Since 1993, limited information has been acquired for these species. There is uncertainty as to whether these species meet the basic criteria for the Survey and Manage Standards and Guidelines: (1) do the reserve system and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance for their persistence? (2) are these species closely associated with late-successional or old-growth forests? and (3) do they occur in the Northwest Forest Plan area?

*Calicium adpersum* is still poorly known in the Northwest Forest Plan area and there is limited information available regarding its distribution, habitat, and abundance. There is uncertainty regarding the identification of the historical record, whether this species occurs in the Northwest Forest Plan area, and if it is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 1999b).

*Chaenotheca subroscida* and *Chaenothecopsis pusilla* are poorly known in the Northwest Forest Plan area. Little is known about the distribution, habitat, and abundance of these species. Because of the difficulty with accurate identification of specimens, it is uncertain if these two species occur in the Northwest Forest Plan area. It is also unknown if these species are closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 2000b). The geographic and biological distribution patterns of *Calicium adpersum*, *Chaenotheca subroscida*, and *Chaenothecopsis pusilla* are unknown at this time.

*Stenocybe clavata* is endemic to the Pacific Northwest (USDA, USDI Species Review Panel 1999b). The number of known sites for this species in the Northwest Forest Plan area has increased from “suspected to occur” in 1993 (Appendix J2 in USDA, USDI 1994b), to about 11 (in Oregon and Washington) (see Table F-2) with only limited survey effort. There is limited habitat data available for this species, and it is uncertain if *Stenocybe clavata* is closely associated with late-successional or old-growth forests (USDA, USDI Species Review Panel 2000b). Current information suggests that *Stenocybe clavata* has a moderate geographic range in the Northwest Forest Plan area, has a widespread but spotty distribution within this range, and occurs in isolated sites.

## Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative *Calicium adpersum*, *Chaenotheca subroscida*, *Chaenothecopsis pusilla*, and *Stenocybe clavata* are in Category 4, and general regional surveys would be required.

The status of these species is undetermined under the three action alternatives, because it is uncertain if they meet the three basic criteria to be included in the Survey and Manage Standards and Guidelines. It is unknown if these four species are closely associated with late-successional or old-growth forests. There is uncertainty if *Calicium adpersum*, *Chaenotheca subroscida*, and *Chaenothecopsis pusilla* occur in the Northwest Forest Plan area. In addition, there is uncertainty regarding concerns for maintaining stable populations for these four species.

*Calicium adpersum*, *Chaenotheca subroscida*, *Chaenothecopsis pusilla*, and *Stenocybe clavata* are in Category 1E under Alternative 1 and Category 2C under Alternative 2. The management is identical under Alternatives 1 and 2, where strategic surveys would be conducted. All current and future known sites would be managed until strategic surveys can determine if the species meet the basic criteria for Survey and Manage. Alternative 3 provides the greatest management for these species. In Alternative 3, these species are in Category 3A, where all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for these species would be required under all action alternatives. There is no site management under the No-Action Alternative. Management of known sites is similar under Alternatives 1 and 2 and that is to maintain the species at the site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. However, if these species are thought to require interior microclimate, there would be little difference between site management under the action alternatives. Based on current information, these species have limited distribution in the Northwest Forest Plan area, or may not occur in this region at all, so management of known sites may not increase the likelihood of maintaining stable populations of these species. In all action alternatives, management of known sites would help maintain the current distribution of populations.

Equivalent-effort surveys prior to habitat-disturbing activities are required for these species under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. However, because these surveys would be conducted relative to project locations, which may not be in the most likely habitat for these species, and because these species are known from few sites, or not known to occur in the Northwest Forest Plan area, these surveys may provide only limited additional information. There may be some loss of sites under the No-Action Alternative and Alternatives 1 and 2, because surveys prior to habitat-disturbing activities would not be conducted. Current information suggests these species are rare in the Northwest Forest Plan area, so it is assumed the likelihood of losing important sites is probably not high.

Strategic surveys would be required under the three action alternatives, and general regional surveys under the No-Action Alternative. These surveys would focus on likely habitats where these species may occur, and address questions necessary for the management of these species. Information from these surveys would: (1) help determine if these species occur in the Northwest Forest Plan area; (2) provide habitat information to determine if these species are closely associated with late-successional or old-growth forests; and, (3) help address species management needs to maintain stable populations of these species in the Northwest Forest Plan area. In addition, any site found with these surveys would be managed to maintain the species at the site under the three action alternatives.

Information regarding distribution, abundance, and habitat, is limited for *Calicium adspersum*, *Chaenotheca subroscida*, *Chaenothecopsis pusilla*, and *Stenocybe clavata*. There is insufficient information regarding these species to determine how any alternative would affect their distribution and stability. However, the concern for these species is greatest under the No-Action Alternative because there is no management of known sites.

### ***Cetrelia cetrarioides*, *Peltigera pacifica*, and *Leptogium teretiusculum***

#### **Background and Affected Environment**

*Cetrelia cetrarioides* and *Leptogium teretiusculum* were included in the Riparian Lichen group for the FEMAT analysis. The ratings for this group reflected concerns because of the narrow riparian buffers for the original Option 9 (USDA et al. 1993). The riparian buffers were increased between the Northwest Forest Plan Draft SEIS and Final SEIS, so this concern may have been reduced somewhat for these species. Concerns were also expressed regarding cumulative effects on nonfederal land (Appendix J2 in USDA, USDI 1994b).

*Peltigera pacifica* was included as one of 20 species in the Nitrogen-fixing lichen group for the FEMAT analysis. A major concern for this group of species was not their rarity, but potential air pollution effects over the 100-year timeframe used in the assessment (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b).

*Cetrelia cetrarioides* and *Peltigera pacifica* occur primarily in riparian forests and hardwood stands, but also in moist forests at low to mid-elevation (McCune and Geiser 1997), and in a range of stand ages (USDA, USDI Species Review Panel 1999b). These species are widespread in the Northwest Forest Plan area west of the Cascade crest (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b and 2000b). Since 1993, the number of known sites have increased for both species. *Cetrelia cetrarioides* has increased from 6 to 49 sites, with 24 recent federal sites. *Peltigera pacifica* has increased from 6 to 46 sites, with 29 recent federal sites (see Table F-2). There are additional undocumented locations (USDA, USDI Species Review Panel 1999b). It is uncertain if these species are closely associated with late-successional or old-growth forests. Current information suggests that *Cetrelia cetrarioides* has a widespread geographic range within the Northwest Forest Plan area, has a widespread but spotty distribution within this range, and occurs in isolated site clusters. Current information also suggests that *Peltigera pacifica* has a widespread geographic range within the Northwest Forest Plan area, has a limited distribution within this range, and occurs in isolated sites.

*Leptogium teretiusculum* is poorly known in the Northwest Forest Plan area. Information is limited on its distribution, habitat, and abundance in this region. It is reported as having a scattered distribution at northern latitudes (Goward et al. 1994). *Leptogium teretiusculum* appears to be rare in the Northwest Forest Plan area based on the number of reported sites (USDA, USDI Species Review Panel 1999b). The species is known from seven sites in the Northwest Forest plan area, from northern Washington to southwest Oregon (USDA, USDI Species Review Panel 2000b). Since 1993 there have been three sites reported from federally managed land (see Table F-2). However, survey efforts have been limited. Current information suggests that *Leptogium teretiusculum* has a widespread geographic range within the Northwest Forest Plan area, has a widespread but spotty distribution within this range, and occurs in isolated sites. It is uncertain if *Leptogium teretiusculum* is closely associated with late-successional or old-growth forests; it is typically found on rock, soil, and the bark of deciduous trees (McCune and Geiser 1997, and USDA, USDI Species Review Panel 2000b).

#### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative *Cetrelia cetrarioides*, *Peltigera pacifica*, and *Leptogium teretiusculum* are in Category 4 and general regional surveys would be required. In the three action alternatives, the status of these species is undetermined. There is uncertainty regarding concerns for maintaining stable populations of these species distributed in a pattern similar to their

reference distribution on federally managed lands within the Northwest Forest Plan area and whether *Cetrelia cetrarioides*, *Peltigera pacifica*, and *Leptogium teretiusculum* are closely associated with late-successional or old-growth forests.

*Cetrelia cetrarioides*, *Peltigera pacifica*, and *Leptogium teretiusculum* are in Category 1E under Alternative 1 and Category 2C under Alternative 2. The management is identical under Alternatives 1 and 2; strategic surveys would be conducted to determine if these species meet the basic criteria for Survey and Manage. All current and future known sites would be managed until strategic surveys can determine if the species meets the basic criteria for Survey and Manage. Alternative 3 provides the greatest protection for these species. Under Alternative 3, these species are in Category 3A, where all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for these species would be required under all action alternatives. There is no known site management under the No-Action Alternative. Management of known sites is similar under Alternatives 1 and 2. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population and could result in larger or more stable populations over time. However, if these species are thought to require interior microclimate, there would be little difference between site management under the action alternatives. Based on current information, *Leptogium teretiusculum* has a limited distribution in the Northwest Forest Plan area, so management of known sites may not increase the likelihood of maintaining a stable population of this species due to its presumed rarity. In all action alternatives, management of known sites would help maintain the current distribution of populations for all three species across their range in the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities are required for these species under Alternative 3. Additional known sites may be discovered and managed as a result of these pre-disturbance surveys. Because these surveys would be conducted relative to project locations, which may not be in the most likely habitat for these species, and because *Leptogium teretiusculum* is known from few sites, these surveys may provide only limited additional information for management. There may be some loss of sites under the No-Action Alternative and Alternatives 1 and 2, because surveys prior to habitat-disturbing activities would not be conducted. Current information suggests *Leptogium teretiusculum* is rare in the Northwest Forest Plan area, so it is assumed the likelihood of losing important sites is probably not high. Current information indicates that *Cetrelia cetrarioides* and *Peltigera pacifica* occur primarily in riparian areas; sites in riparian areas would receive some protection if management treatments maintain or provide the habitat required by these species.

Strategic surveys would be required under the three action alternatives; general regional surveys would be required under the No-Action Alternative. These surveys could focus on likely habitats where these species may occur and address questions necessary for the management of these species. Information from these surveys could provide habitat information to determine if these species are closely associated with late-successional or old-growth forests, and help address species management needs to maintain stable populations on federally managed lands within the Northwest Forest Plan area. In addition, any site found with these surveys would be managed to maintain the species at the site under the three action alternatives.

Under all alternatives, there would be indirect management for populations of these three species that are associated with riparian areas. A portion of their populations may be provided for by the reserve land allocations, particularly riparian buffers under the Aquatic Conservation Strategy, even under the No-Action alternative where there is no management of known sites. The contribution of populations in the Riparian Reserves and other reserve allocations to providing for stable populations of these species is unknown.



Information regarding distribution, abundance, and habitat is limited for *Leptogium teretiusculum*. Because so little is known about this species, there is insufficient information to determine how any alternative would affect its distribution and stability. However, the concern for *Leptogium teretiusculum* is greatest under the No-Action Alternative because there is no management of known sites.

Alternative 3 provides the greatest management for *Cetrelia cetrarioides* and *Peltigera pacifica*, because of the requirement for pre-disturbance surveys. Alternatives 1 and 2 are similar in management of *Cetrelia cetrarioides* and *Peltigera pacifica*, and the concern for these species is probably only slightly higher than under Alternative 3. While there is a moderate level of uncertainty (due to their occurrence at lower elevations and it is unknown how much potential habitat exists on federally managed lands), Alternatives 1, 2, and 3 would provide sufficient habitat (including known sites) to allow *Cetrelia cetrarioides* and *Peltigera pacifica* to stabilize in a pattern similar to their reference distribution. While there is a high level of uncertainty, the No-Action Alternative would provide sufficient habitat (including known sites) to allow these two species to stabilize in a pattern similar to their reference distribution.

### ***Buellia oidalea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa***

#### **Background and Affected Environment**

*Buellia oidalea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* are considered rare in the Northwest Forest Plan area. There are high concerns for these species because of low number of known sites, low numbers of individuals, limited distributions, and narrow ecological amplitudes (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). Current information suggests these species may not be closely associated with late-successional or old-growth forests, which is one of the three basic criteria for inclusion in the Survey and Manage Standards and Guidelines (USDA, USDI 2000b and USDA, USDI Species Review Panel 1999b and 2000b).

*Pannaria rubiginosa* was one of six species included in the Rare Nitrogen-fixing group under the Northwest Forest Plan. Low ratings for this group indicated high concern for this species because of its limited distribution, apparent rarity, and sensitivity to air pollution (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). *Pannaria rubiginosa* has a broad global distribution (Purvis et al. 1992). In 1993, it was only known from two sites in Oregon (Appendix J2 in USDA, USDI 1994b), but is now known from a total of 17 sites within the Northwest Forest Plan area; 8 are recent federal sites (see Table F-2). It is known from three historical collections in Washington (USDA, USDI 2000b). This species is found in low elevation moist conifer and deciduous forests, and in willow and shrub thickets in coastal dune areas (USDA, USDI 2000b; McCune et al. 1997; and McCune and Geiser 1997). Current information suggests that *Pannaria rubiginosa* has a widespread geographic range within the Northwest Forest Plan area, its distribution is limited throughout this range, and it occurs in isolated sites.

*Buellia oidalea* was one of 12 lichen species in the Rare Oceanic-Influenced Lichen group, and *Pyrrhospora quernea* was one of four species in the Common Oceanic-Influenced Lichens group evaluated in the FEMAT analysis. The Rare Oceanic group had the lowest ratings in the lichen analysis. These ratings indicated a high level of concern for these species because of their rarity in the Northwest Forest Plan area (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). At that time they were known only from one or few populations in the Northwest Forest Plan area, and had limited distribution. In the Pacific Northwest, they occur along the immediate coast from central Oregon south into California, and the populations are typically disjunct and isolated. Ratings were also low for the Common Oceanic-Influenced Lichen group, and similar concerns were expressed for these species as well (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b).

*Buellia oidalea* is endemic to the Pacific Coast of North America, and is known from Baja, California north to Vancouver Island, British Columbia. This species was known only from two

locations in 1993 (Appendix J2 in USDA, USDI 1994b), and is now known from six locations along the coast in the Northwest Forest Plan area (USDA, USDI 2000b). *Buellia oidealea* is only reported from one recent federal site (see Table F-2). The higher number of pre-FEMAT sites in Table F-2 may represent multiple collections from a single location. *Buellia oidealea* occurs on red alder, Monterey cypress, Sitka spruce, shore pine, willow, on redwood posts, and shrubs (USDA, USDI 2000b). Its occurrence on young shore pine towards the coast from Carter Lake in Douglas County, Oregon, suggests it may be more common north of California than the few records indicate (McCune et al. 1997). Current information suggests that *Buellia oidealea* has a very limited geographic range within the Northwest Forest Plan area, is limited to a small portion within this range, and occurs in isolated sites.

*Pyrrhospora quernea* is known to occur along the coast in western North America from Washington to California (USDA, USDI 2000b), as well as in other parts of North America, Europe, and Micronesia (Purvis et al. 1992). Since 1993, the number of known sites for this species has increased from 4 to 13 in the Northwest Forest Plan area, with 4 known to be on federally managed land (USDA, USDI 2000b and Appendix J2 in USDA, USDI 1994b). Apparently not all of these sites are currently in the ISMS database (see Table F-2). *Pyrrhospora quernea* is found along the immediate coast in estuaries, stabilized dunes, and rocky headlands on Sitka spruce and shore pine in older forests; on oak, alder, elderberry, and other coastal shrubs; and on old board fences and other wood (USDA, USDI 2000b). Current information suggests that *Pyrrhospora quernea* has a limited geographic range within the Northwest Forest Plan area, has a limited distribution throughout this range, and occurs in isolated site clusters.

### Environmental Consequences and Comparison of Alternatives

Under the No-Action Alternative, *Buellia oidealea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* are in Categories 1 and 3. Under these categories, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be selected for management.

The status of *Buellia oidealea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* is undetermined in the three action alternatives because of the uncertainty about whether these species meet the basic criteria for inclusion in Survey and Manage. It is uncertain if *Buellia oidealea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* are closely associated with late-successional or old-growth forests.

*Buellia oidealea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* are in Category 1E under Alternative 1 and Category 2C under Alternative 2. The management is identical under Alternatives 1 and 2, where strategic surveys would be conducted to determine if these species meet the basic criteria for Survey and Manage. All current and future known sites would be managed until strategic surveys can determine if the species meets the basic criteria for Survey and Manage. Alternative 3 provides the greatest management for these species. In Alternative 3, these species are in Category 3A, where all current and future known sites would be managed with a 250-meter buffer. Equivalent-effort surveys would be conducted before habitat-disturbing activities, with the objective to find occupied sites and minimize the inadvertent loss of undiscovered sites. Strategic surveys would be conducted to address species information and management needs.

Management of known sites for *Buellia oidealea*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* would be required under all alternatives. Management of known sites is similar under the No-Action Alternative and Alternatives 1 and 2 and that is to maintain the species at the site. The prescribed area for known sites under Alternative 3 may provide larger habitat areas for recruitment and expansion of the population, and could result in larger, or more stable populations over time. However, if these species are thought to require interior microclimate, there would be little difference between site management under the action alternatives. Management of known sites would help maintain the current distribution of populations on federally managed lands. Since these species have restricted distributions, few known sites, and few sites on federally

managed land, the management of known sites would not increase the likelihood of maintaining stable populations for these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area.

Equivalent-effort surveys prior to habitat-disturbing activities would be required for these three species under Alternative 3. *Buellia oideale*, *Pyrrhospora quernea*, and *Pannaria rubiginosa* receive greater management under Alternative 3 compared to the other alternatives because of this requirement for pre-disturbance surveys. Because these species are restricted in their geographic distribution, occur in specialized habitat, and little habitat occurs on federally managed land, only a few new populations would likely be discovered. Sites discovered by these surveys would be managed and contribute to providing a distribution of populations across the species ranges in the Northwest Forest Plan area. There could be loss of sites under Alternatives 1 and 2 and the No-Action Alternative because surveys prior to habitat-disturbing activities would not be conducted. There is a concern that this potential loss of sites could eliminate populations that are important to provide for stable populations of these species.

Strategic surveys would be required under the three action alternatives, and extensive surveys under the No-Action Alternative. These surveys would focus on likely habitats where these species may occur, and address questions necessary for the management of these species. Information from these surveys would: (1) determine if these species are closely associated with late-successional or old-growth forests; (2) address species management needs to maintain stable populations of these species on federally managed lands within the Northwest Forest Plan area; and, (3) determine the appropriate management for reducing concerns for *Buellia oideale*, *Pyrrhospora quernea*, and *Pannaria rubiginosa*. Under all alternatives, any site found with these surveys would be managed to maintain the species at the site.

Alternative 3 provides greater management for *Buellia oideale*, *Pyrrhospora quernea*, and *Pannaria rubiginosa*, because of the requirement for pre-disturbance surveys. There is a slight increase in concern for these species under the No-Action Alternative and Alternatives 1 and 2 because there are no pre-disturbance surveys. While there is a high level of uncertainty because they have limited distribution and limited populations, few populations on federally managed land, and limited potential suitable habitat on federally managed land, all alternatives would provide inadequate habitat (including known sites) to maintain *Buellia oideale* and *Pyrrhospora quernea*.

All alternatives would provide sufficient habitat (including known sites) to allow *Pannaria rubiginosa* to stabilize in a pattern similar to its reference distribution, although with a high level of uncertainty. The uncertainty associated with this outcome is due to a limited distribution and limited populations, few populations on federally managed land, and possibly limited potential suitable habitat on federally managed land, as well as lack of knowledge and the potential for stochastic events.

### ***Nephroma bellum* and *Pannaria saubinetii***

#### **Background and Affected Environment**

*Nephroma bellum* and *Pannaria saubinetii* were included in the Nitrogen-fixing Lichen group for the FEMAT analysis. The outcome ratings indicated concern for this group of 20 species because nitrogen-fixing lichens are known to be among the most sensitive lichens to air pollution effects (Hawksworth and Hill 1984 in USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b). The major concern for this group of species was not their rarity, but potential air pollution effects over the 100-year timeframe used in the assessment (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b; and USDA, USDI Species Review Panel 1999b).

*Nephroma bellum* has a broad global distribution (Purvis et al. 1992) and is well distributed west of the Cascade crest (USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased for *Nephroma bellum* from 9 to 135, with 117 recent federal sites (USDA, USDI Species Review Panel 2000b). There are additional

undocumented sites (USDA, USDI Species Review Panel 1999b). This species is widespread and occurs in various habitats and stand ages, on trees, shrubs, and mossy rocks in moist hardwood and conifer forests, and riparian areas from low to mid-elevation, mainly west of the Cascade crest (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b).

*Pannaria saubinetii* has a broad global distribution (Purvis et al. 1992). It is widespread and occurs in various habitats and stand ages, on trees (mainly hardwoods), shrubs, and mossy rocks in moist hardwood and conifer forests, and riparian areas from low to mid-elevation, mainly west of the Cascade crest (McCune and Geiser 1997 and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites in the Northwest Forest Plan area has increased from 12 to 145, with 114 recent federal sites (USDA, USDI Species Review Panel 2000b). There are additional undocumented sites (USDA, USDI Species Review Panel 1999b).

Current information indicates that *Nephroma bellum* and *Pannaria saubinetii* may be common species in the Northwest Forest Plan area. At this time, there is an unknown concern for their persistence, as the reserve land allocations, and other standards and guidelines of the Northwest Forest Plan are likely to provide for stable populations of *Nephroma bellum* and *Pannaria saubinetii* on federally managed lands within the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). Current information suggests that *Nephroma bellum* and *Pannaria saubinetii* both have widespread geographic ranges within the Northwest Forest Plan area, have limited distributions throughout this area, and occur in isolated site clusters.

### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative *Nephroma bellum* and *Pannaria saubinetii* are in Category 4 and general regional surveys would be required. In the three action alternatives, the status of these species is undetermined. There is uncertainty regarding whether the species meet the basic criteria for Survey and Manage, that is, do the reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance of maintaining stable populations on federally managed lands within the Northwest Forest Plan area.

Under Alternative 1, *Nephroma bellum* and *Pannaria saubinetii* are in Category 1F. Strategic surveys would be conducted to determine if these species meet the basic criteria for inclusion in the Survey and Manage Standards and Guidelines. Under Alternative 2, these species are in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Based on strategic survey information, these species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. Under Alternative 3, these species are in Category 3C. Under this category, all current and future known sites would be managed, and strategic surveys would be conducted to determine if these species meet the basic criteria for inclusion in the Survey and Manage Standards and Guidelines.

Known site management varies for these species under the different alternatives. Alternative 3 provides the greatest protection for sites of these species, as all current and new known sites would be managed. There is no site management requirement under the No-Action Alternative and Alternative 1. Under Alternative 1, known sites would receive no protection while strategic surveys would determine management necessary for these species to provide for stable populations on federally managed lands within the Northwest Forest Plan area. Concern for these species would increase under Alternative 1 and the No-Action Alternative if it is later determined that these sites were important for maintaining stable populations distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. Because these species have relatively large numbers of recent sites, and over half of the recent federal sites occur in reserve land allocations other than Riparian Reserves, the concern for these species is low.

Under Alternative 2, only sites known as of September 30, 1999, would be managed and there would be no pre-disturbance surveys. This may result in loss of sites that may be important to

maintain stable populations of these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. Following completion of strategic surveys after 5 years, these species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Under all alternatives, there would be indirect management for those populations of *Nephroma bellum* and *Pannaria saubinetii* that occur in reserve land allocations, including riparian areas, provided the management activities in these areas maintain or provide habitat that is required by these species. Over half of the recent federal sites of *Nephroma bellum* and *Pannaria saubinetii* occur in reserve land allocations other than Riparian Reserves. At this time it is unknown what the contribution is of populations in the Riparian Reserves and other reserve allocations to providing for stable populations of these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area.

Strategic surveys would be required for *Nephroma bellum* and *Pannaria saubinetii* under the three action alternatives, and as general regional surveys under the No-Action Alternative. Under Alternative 2 these surveys would be completed within 5 years. These surveys would: (1) provide information regarding the distribution, habitat requirements, and expected populations of *Nephroma bellum* and *Pannaria saubinetii* throughout the Northwest Forest Plan area; and, (2) confirm if these species are closely associated with late-successional or old-growth forests. Information from these surveys would help determine if the reserve land allocations provide for these species, and what the appropriate management is to maintain stable populations. Strategic surveys would be effective in gathering information about these species, as they would focus in areas with a high likelihood of locating the species. Strategic surveys could provide the information necessary to determine the appropriate management to address concerns for these species throughout their ranges within the Northwest Forest Plan area.

In conclusion, Alternative 3 would provide the most management for *Nephroma bellum* and *Pannaria saubinetii* because of the management of all current and future known sites. Alternative 3 is also most likely to provide for stable populations of these species within the Northwest Forest Plan area. The least management occurs under the No-Action Alternative and Alternative 1 because there is no site management. The large increase in the number of known sites and the current distribution of these species indicates these species may be common in the Northwest Forest Plan area. All alternatives would provide sufficient habitat (including known sites) to allow these species to stabilize in a pattern similar to their reference distributions.

### ***Hypogymnia oceanica***

#### **Background and Affected Environment**

*Hypogymnia oceanica* is a Pacific Northwest endemic, ranging from Alaska to central Oregon. It occurs primarily in moist conifer forests on the immediate coast, on shore pine and Sitka spruce, and in low to mid-elevation forests in the western Cascades (McCune and Geiser 1997; USDA, USDI 2000b; and USDA, USDI Species Review Panel 1999b). Since 1993, the number of known sites for this species in the Northwest Forest Plan area has increased from 3 to 237, with 223 recent federal sites (see Table F-2). About 25 percent of the federal known sites are in reserve land allocations (USDA, USDI Species Review Panel 2000b). *Hypogymnia oceanica* was one of 12 species included in the Rare Oceanic-Influenced Lichens group during the FEMAT analysis (USDA et al. 1993). This species was thought to be rare and limited in distribution to the immediate coast, with only one known site (Appendix J2 in USDA, USDI 1994b).

*Hypogymnia oceanica* is now known to be more widespread geographically and with more populations than previously thought (USDA et al. 1993; Appendix J2 in USDA, USDI 1994b, and USDA, USDI Species Review Panel 1999b and 2000b). Abundance data is limited for this species. Available information indicates that it is typically not abundant where it occurs and generally few individuals are found in a local population (USDA, USDI 2000b and USDA, USDI

Species Review Panel 1999b). At this time, there is an uncertain concern for the species persistence, as the reserve land allocations, and other standards and guidelines of the Northwest Forest Plan may provide a reasonable assurance of a stable population in the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c). Current information suggests this species has a moderate geographic range within the Northwest Forest Plan area, has a widespread but spotty distribution within this range, and has the potential for limited connectivity among sites.

### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, *Hypogymnia oceanica* is in Categories 1 and 3. Under these categories, all current and future known sites would be managed, extensive surveys would be required, and high-priority sites would be selected for management.

In the three action alternatives, the status of *Hypogymnia oceanica* is undetermined. There is uncertainty regarding whether this species meets the basic criteria for Survey and Manage; that is, do the reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance of maintaining a stable population on federally managed lands within the Northwest Forest Plan area.

Under Alternative 1 *Hypogymnia oceanica* is in Category 1F and strategic surveys would be conducted to determine if this species meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines. Under Alternative 2 this species is in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Based on strategic survey information, this species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. Under Alternative 3, this species is in Category 3C. Under this category, all current and future known sites would be managed, and strategic surveys would be conducted to determine if this species meets the basic criteria for inclusion in the Survey and Manage Standards and Guidelines.

Known site management varies for *Hypogymnia oceanica* under the different alternatives. The No-Action Alternative and Alternative 3 provide the greatest protection for sites of this species, as all current and new known sites would be managed. There is no site management requirement under Alternative 1. Under Alternative 1, known sites would receive no protection while strategic surveys determine what management is necessary for this species to provide for a stable population on federally managed lands. Concern for this species may increase under Alternative 1 if it is later determined that these sites were important for maintaining a stable population on federally managed lands within the Northwest Forest Plan area. Because *Hypogymnia oceanica* has a large number of recent sites, although a relatively low number occur in reserve land allocations, due in part to the emphasis of survey efforts in project areas, the likelihood of loss of sites under Alternative 1 is probably moderate to low.

Under Alternative 2, only sites known as of September 30, 1999, would be managed and there would be no pre-disturbance surveys. This may result in loss of unknown sites that may be important to maintain a stable population of this species distributed in a pattern similar to its reference distribution on federally managed lands within the Northwest Forest Plan area. Following completion of strategic surveys after 5 years, this species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Under all alternatives, there would be indirect management for those populations of *Hypogymnia oceanica* that occur in reserve land allocations, including riparian areas, provided the management activities in these areas maintain or provide habitat that is required by this species. At this time it is unknown what the contribution is of populations in the reserve land allocations to providing for stable populations of this species on federally managed lands within the Northwest Forest Plan area.

Strategic surveys would be required for *Hypogymnia oceanica* under the three action alternatives, and as extensive surveys under the No-Action Alternative. Under Alternative 2 these surveys would be completed within 5 years. These surveys would provide information regarding the distribution, habitat requirements, and expected populations of *Hypogymnia oceanica* throughout the Northwest Forest Plan area. Information from these surveys would help determine if the reserve land allocations provide for this species, and what the appropriate management is to maintain a stable population on federally managed lands within the Northwest Forest Plan area. Strategic surveys would be effective in gathering information about this species, as they would focus in areas with a high likelihood of locating the species. Strategic surveys could provide the information necessary to determine the appropriate management to address concerns throughout its range within the Northwest Forest Plan area.

In conclusion, the No-Action Alternative and Alternative 3 would provide the most protection for *Hypogymnia oceanica* because of the management of all current and future known sites. The least management occurs under the Alternative 1 because there is no known site management. The large increase in the number of known sites and the current distribution of this species indicates *Hypogymnia oceanica* may be more common and widespread, and occur in a broader range of habitats, in the Northwest Forest Plan area than previously thought. All alternatives would provide sufficient habitat (including known sites) to allow this species to stabilize in a pattern similar to its reference distribution.

### ***Calicium glaucellum*, *Calicium viride*, and *Chaenotheca furfuracea***

#### **Background and Affected Environment**

*Calicium glaucellum*, *Calicium viride*, and *Chaenotheca furfuracea* were included in the group of 16 pin lichens evaluated during the FEMAT analysis. The Pin Lichen group was rated as having a low likelihood of having habitat of sufficient quality, distribution and abundance to allow the species to maintain a stable, well-distributed population across federally managed lands within the Northwest Forest Plan area (USDA et al. 1993). This was because they were thought to be late-successional or old-growth associated species and little was known of their distribution, ecology, or abundance in the Pacific Northwest (USDA et al. 1993 and Appendix J2 in USDA, USDI 1994b).

*Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* are more common and widespread than known at the time of the FEMAT analysis (USDA et al. 1993 and USDA, USDI Species Review Panel 1999b and 2000b). These lichens are very small, which presents survey difficulties (Appendix J2 in USDA, USDI 1994b). However, limited survey efforts by tax experts in the federal agencies and universities have reported many new sites (USDA, USDI Species Review Panel 1999b and 2000b). Since 1993, there has been an increase in the number of known sites for the following species: *Calicium glaucellum* from 2 to 64 with 57 recent federal sites; *Chaenotheca furfuracea* from 3 to 29 with 21 recent federal sites; and *Calicium viride* from 2 to 85 with 71 recent federal sites (see Table F-2). Most of the recent sites for these species occur in reserve land allocations (USDA, USDI Species Review Panel 1999b and 2000b).

*Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* have broad global distributions (Tibell 1975). *Calicium glaucellum* and *Calicium viride* are widespread in the Northwest Forest Plan area, have broad ecological amplitude, and occur in a variety of habitats and stand ages (Tibell 1975 and USDA, USDI Species Review Panel 1999b and 2000b). *Calicium glaucellum* occurs on bark, wood, stumps, snags, lumber, and branches of various types of conifer species in open sites with ample light, open dry forests, and edges of older forests. *Calicium viride* is found on a variety of substrates including conifers, bark, wood, and snags. *Chaenotheca furfuracea* is widespread in distribution, but appears restricted to specific microsites, although these microsites can occur in a wide variety of habitats and stand ages (USDA, USDI Species Review Panel 1999b). Current information suggests that *Chaenotheca furfuracea* and *Calicium viride* have widespread geographic ranges within the Northwest Forest Plan area, have limited distributions within this range, and occur in isolated site clusters. *Calicium glaucellum* has a

widespread geographic range within the Northwest Forest Plan area, has a widespread but spotty distribution within this range, and occurs in isolated site clusters.

Current information indicates that *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* may be common species in the Northwest Forest Plan area. At this time, there is an unknown concern for their persistence, as the reserve land allocations and other standards and guidelines of the Northwest Forest Plan may provide a reasonable assurance of stable populations of *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* on federally managed lands within the Northwest Forest Plan area (USDA, USDI Species Review Panel 1999b, 2000b, and 2000c).

### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* are in Category 4 and general regional surveys would be required. In the three action alternatives, the status of these species is undetermined. There is uncertainty regarding whether these species meet the basic criteria for Survey and Manage; that is, do the reserve land allocations and other standards and guidelines of the Northwest Forest Plan provide a reasonable assurance of maintaining stable populations of *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* on federally managed lands within the Northwest Forest Plan area.

Under Alternative 1, *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* are in Category 1F. Strategic surveys would be conducted to determine if these species meet the basic criteria for inclusion in the Survey and Manage Standards and Guidelines. Under Alternative 2, these species are in Category 2D, where all sites known as of September 30, 1999, would be managed, and strategic surveys would be completed within 5 years. Based on strategic survey information, these species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. Under Alternative 3, these species are in Category 3C. Under this category, all current and future known sites would be managed, and strategic surveys would be conducted to determine if these species meet the basic criteria for inclusion in the Survey and Manage Standards and Guidelines.

Known site management varies for these species under the different alternatives. Alternative 3 provides the greatest protection for sites of these species, as all current and new known sites would be managed. There is no site management requirement under the No-Action Alternative and Alternative 1. Under Alternative 1, known sites would receive no protection while strategic surveys would determine management necessary for these species to provide for stable populations distributed in a pattern similar to, or altered from, their reference distributions on federally managed lands within the Northwest Forest Plan area. Concern for these species would increase under Alternative 1 and the No-Action Alternative if it is later determined that these sites were important for maintaining stable populations of these species on federally managed lands within the Northwest Forest Plan area. Because these species have relatively large numbers of recent sites despite limited survey efforts, and over half of the recent federal sites occur in reserve land allocations other than Riparian Reserves, concern for these species is low.

Under Alternative 2, only sites known as of September 30, 1999, would be managed and there would be no pre-disturbance surveys. This may result in loss of sites that may be important to maintain stable populations of these species distributed in a pattern similar to their reference distribution on federally managed lands within the Northwest Forest Plan area. Following completion of strategic surveys after 5 years, these species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed.

Under all alternatives, there would be indirect management for those populations of *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* that occur in reserve land allocations, including riparian areas, provided the management activities in these areas maintain or provide



habitat that is required by these species. A high percentage of the recent federal sites for these three species occur in reserve land allocations other than Riparian Reserves. At this time, it is unknown what the contribution is of populations in reserve allocations to providing for stable populations of these species.

Strategic surveys would be required for *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* under the three action alternatives; general regional surveys would be required under the No-Action Alternative. Under Alternative 2 these surveys would be completed within 5 years. These surveys would provide information regarding the distribution, habitat requirements, and expected populations of *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride* throughout the Northwest Forest Plan area, and confirm if these species are closely associated with late-successional or old-growth forests. Information from these surveys would help determine if the reserve land allocations provide for these species, and what the appropriate management is to maintain stable populations on federally managed lands within the Northwest Forest Plan area. Strategic surveys would be effective in gathering information about these species, as they would focus in areas with a high likelihood of locating the species. Strategic surveys could provide the information necessary to determine the appropriate management to address concerns for these species throughout their ranges within the Northwest Forest Plan area.

In conclusion, Alternative 3 would provide the most management for *Calicium glaucellum*, *Chaenotheca furfuracea*, and *Calicium viride*, because of the management of all current and future known sites. However, the concern for these species is low under the No-Action Alternative and Alternatives 1 and 2, given the large increase in the number of known sites despite limited survey efforts, the widespread distribution of these species, and their broad ecological amplitude. All alternatives would provide sufficient habitat (including known sites) to allow these three species to stabilize in a pattern similar to their reference distributions.

## Vascular Plants

### Background and Affected Environment

The largest and most dominant organisms of the late-successional and old-growth forest ecosystem are the vascular plants, some of which grow taller than 300 feet and have lifespans greater than 1,000 years. Ranging from the dominant conifers to the delicate ferns, vascular plants are defined as those that contain conducting or vascular tissue. They include seed-bearing plants (flowering plants and conifers) and spore-bearing forms such as ferns, horsetails, and clubmosses. Vascular plants create the structure of the forest and function as the primary producers, capturing sunlight through photosynthesis and converting their energy to foods consumed by animals and fungi.

The Survey and Manage Standards and Guidelines were originally applied to 16 vascular plant species in the Northwest Forest Plan ROD. Field surveys, research, and monitoring conducted since 1994 have provided additional information on the abundance, distribution, and range for most of these species (USDA, USDI Species Review Panel 1999b). Additional sites have been located for all species. The number of known sites has increased considerably for some. For example, an additional 957 sites have been located on federally managed land since 1994 for *Allotropa virgata*, increasing the number of federal known sites by a factor of seven. Field surveys have extended known ranges farther south for *Botrychium minganense* and *Corydalis aquae-gelidae*, whereas re-examination of vouchers and known sites has reduced the known ranges of *Coptis asplenifolia* and *Platanthera orbiculata* var. *orbiculata*. The two latter species were previously thought to occur in Oregon and Washington, but are now known to be restricted to the State of Washington (USDA, USDI 1998c). Four species (*Arceuthobium tsugense*, *Clintonia andrewsiana*, *Pedicularis howellii*, and *Scoliopus bigelovii*) have been determined to occur in a wider range of habitats and seral stages (Hildebrand 1995, Williams 1999, Williams 1996a, and Williams 1996b). Additional information obtained for *Arceuthobium tsugense* resulted in a change

in the Survey and Manage Standards and Guidelines in 1995 (REO Memorandum, July 24, 1995). The Component 1 and 2 status was changed to Component 4 and the application of the standards and guidelines was restricted to the subspecies *Arceuthobium tsugense* ssp. *mertensianae* in the State of Washington.

As stated in Chapter 2 of the Draft SEIS, the Species Review Panel met in the spring of 1999 to review existing data and assign each of the 16 vascular plant species into management categories for each of the three action alternatives. The Species Review Panel was reconvened in the spring of 2000 to review new data collected in 1999 and determine if changes in management categories were warranted in the Final SEIS. The panel determined that the new data collected in 1999 for vascular plants was not substantial and made no changes in management categories. The primary reasons for assignment into the different management categories are summarized for each of the vascular plant species in Appendix F (Table F-2).

Effects analysis for vascular plants are based on historic patterns of biological distribution which are used as reference distributions. Reference distributions are the basis for conclusions. Since these patterns have never been documented, projections have been made for this analysis based on current patterns of suitable habitat, past patterns of disturbance, and the distribution of documented sites obtained from management recommendations, survey protocols, and species review panels notes (USDA, USDI 1998c, USDA, USDI 1998g, and USDA, USDI Species Review Panel 1999b). Vascular plants fell into three distribution patterns. *Arceuthobium tsugense* ssp. *mertensianae*, *Bensoniella oregana* (California), *Coptis asplenifolia*, *Coptis trifolia*, and *Eucephalus vialis* are limited to isolated sites across their range. *Botrychium minganense*, *Botrychium montanum*, and *Platanthera orbiculata* var. *orbiculata* are distributed across their range in isolated site clusters. *Allotropa virgata*, *Clintonia andrewsiana*, *Corydalis aquae-gelidae*, *Cypripedium fasciculatum*, *Cypripedium montanum*, *Galium kamtschaticum*, *Pedicularis howellii*, and *Scoliopus bigelovii* are distributed with limited connectivity among multiple sites and/or clusters. More detailed descriptions of range and distribution are provided in the management recommendations and survey protocols prepared for each species (USDA, USDI 1998c and 1998g).

## Summary of Effects

Under the action alternatives, four species of vascular plants (*Allotropa virgata*, *Clintonia andrewsiana*, *Pedicularis howellii*, and *Scoliopus bigelovii*) would be removed from the Survey and Manage Standards and Guidelines throughout their range and two other species (*Botrychium minganense* in Washington and *Galium kamtschaticum* in the WA Western Cascades, north of Snoqualmie Pass) would be removed from the Survey and Manage Standards and Guidelines in part of their range. These species no longer meet the basic criteria for Survey and Manage Standards and Guidelines in all or part of their range (see Table 2-2 and Table F-2). All six of the vascular plants that would be removed from Survey and Manage in all or a part of their range, are expected to have sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distribution.

For the 12 species remaining under the Survey and Manage Standards and Guidelines in all or part of their range, strategic surveys would be conducted under all of the action alternatives. The provision for conducting strategic surveys for all 12 species would increase the efficiency and effectiveness of species management in the future by prioritizing and targeting surveys to address specific questions relative to species management. General regional surveys are required for only one vascular plant, *Arceuthobium tsugense* ssp. *mertensianae* in the No-Action Alternative. *Arceuthobium tsugense* ssp. *mertensianae*, would also have the management of known sites requirement added under Alternatives 2 and 3.

The three action alternatives have similar provisions for adaptive management to allow the Agencies to respond to changing information and to provide appropriate management for species. Adaptive management would result in more effective species management by assigning the

species to the category that provides the appropriate level of mitigation needed for continuation of the species within the Northwest Forest Plan area.

Two species, *Cypripedium fasciculatum* and *Cypripedium montanum*, would have the range of application of the Survey and Manage Standards and Guidelines increased from the Klamath Mountain Province (*C. fasciculatum*) and west Cascades (*C. montanum*) to the entire Northwest Forest Plan area in all of the action alternatives.

Four species, *Corydalis aquae-gelidae*, *Cypripedium fasciculatum*, *Cypripedium montanum*, and *Platanthera orbiculata* var. *orbiculata*, would have the pre-disturbance survey requirement removed in Alternative 2.

The 12 vascular plant species that remain under the Survey and Manage Standards and Guidelines in all or a part of their range are also expected to have sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distribution under all alternatives except for *Eucephalus vialis*, *Cypripedium fasciculatum*, and *Cypripedium montanum*. *Eucephalus vialis* would stabilize in a pattern different from the reference distribution under all alternatives. *Cypripedium fasciculatum* and *Cypripedium montanum* would stabilize in a pattern different from the reference distribution in the No-Action Alternative.

## Environmental Consequences and Comparison of Alternatives

The discussion of environmental consequences for vascular plants is organized according to whether the Survey and Manage Standards and Guidelines are removed, reduced, or retained under the action alternatives. Four species would be removed from Survey and Manage in all of their range, two species would be removed in a portion of their range, and 10 other species would remain under the Survey and Manage Standards and Guidelines.

### Species that would be Removed from the Survey and Manage Standards and Guidelines Throughout Their Ranges

Four vascular plants would be removed from the Survey and Manage Standards and Guidelines throughout their ranges. This includes *Allotropa virgata*, *Clintonia andrewsiana*, *Pedicularis howellii*, and *Scoliopus bigelovii*. All four species are in Category 1 and 2 in the No-Action Alternative. *Pedicularis howellii* is also a Protect From Grazing species in the No-Action Alternative. Category 1 requires management of known sites and Category 2 requires pre-disturbance surveys.

*Allotropa virgata* was identified at 957 locations on federally managed land between 1994 and 1999, increasing the number of federal known sites by a factor of seven. Previously, *Allotropa virgata* was thought to be limited to low elevation forests (USDA, USDI 1994a). Surveys conducted since 1994 have located the species at elevations up to 10,000 feet in *Abies amabilis* (silver fir) forests. Potential habitat in reserves is expected to support additional populations of *Allotropa virgata* based on survey efforts conducted since 1993 (USDA, USDI 1998g). The increase in the abundance and distribution, in combination with the availability of potential habitat in reserve land allocations, has reduced concerns for this species (USDA, USDI Species Review Panel 1999b). *Allotropa virgata* no longer meets the basic criteria for inclusion under the Survey and Manage Standards and Guidelines because the reserve system provides for a reasonable assurance that the species will meet stability and distribution objectives and would be removed from the Survey and Manage Standards and Guidelines under the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution and occupancy of potential habitat in reserves), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Clintonia andrewsiana* is limited to the redwood forests of northern California, and long-term survival of the species across its range has never been a concern. The FEMAT gave a very high likelihood of this species being well distributed and stable across federally managed lands. Since 1994, *Clintonia andrewsiana* has been found to occur in a wider range of habitats (roadsides, trails, exposed ridges, and old logging roads) and is not considered closely associated with late-successional and old-growth forests (Williams 1996a and USDA, USDI Species Review Panel 1999b). For this reason, it does not meet the basic criteria for the Survey and Manage Standards and Guidelines. Removal of the Survey and Manage Standards and Guidelines should not substantially affect the species. *Clintonia andrewsiana* was originally rated by FEMAT as stable and well distributed without Survey and Manage Standards and Guidelines (USDA, USDI 1994a). While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Pedicularis howellii* is not a concern because of its habitat association and the proportion of sites in reserve land allocations. *Pedicularis howellii* is no longer considered closely associated with late-successional and old-growth forests (USDA, USDI Species Review Panel 1999b). Recent analysis indicates that approximately 30 percent of the populations are associated with streams, lakes, and meadows, and 40 percent are located along forest edges created by trails, roads, and other forest canopy openings (Williams 1999). Williams (1999) also estimated approximately 95 percent of the populations as occurring in reserve habitats. For these reasons, *Pedicularis howellii* no longer meets the basic criteria for inclusion under the Survey and Manage Standards and Guidelines and it would be removed under the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

*Scolioopus bigelovii* is not a concern throughout the species range because of its habitat association and abundance (USDA, USDI Species Review Panel 1999b). *Scolioopus bigelovii* has been located in a variety of habitats including clearcuts, second and third-growth forests of 30 to 40 years, rock outcrops, rocky headlands, road cutbanks, highway rights-of-way, fire trails, hardwood forests, and edges of parking lots (Williams 1996b). *Scolioopus bigelovii* no longer meets the basic criteria for Survey and Manage because it is not closely associated with late-successional and old-growth forests and it would be removed under the action alternatives. FEMAT reported a very high likelihood of this species being well distributed and stable across federally managed lands. While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

### **Species that would be Removed from the Survey and Manage Standards and Guidelines in Part of Their Ranges**

*Botrychium minganense* and *Galium kamtschaticum* would be removed from the Survey and Manage Standards and Guidelines in a portion of their ranges within the Northwest Forest Plan area. They are in Categories 1 and 2 under the No-Action Alternative and Categories 1A, 2A, and 3A under the action alternatives for those portions of their ranges remaining under Survey and Manage.

*Botrychium minganense* is known from Washington, Oregon, and California. It is no longer a concern in the State of Washington because of the number of sites in reserve land allocations (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b). The species no longer meets the basic criteria for Survey and Manage in Washington and would be removed from the Survey and Manage Standards and Guidelines in the state of Washington under the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge

(predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

The current known range of *Galium kamtschaticum* within the Northwest Forest Plan area is limited to the Olympic and Cascades Mountains north of Snoqualmie Pass in the State of Washington. *Galium kamtschaticum* is not a concern in the WA Western Cascades Physiographic Province of the Mt. Baker-Snoqualmie National Forest because a high number of healthy populations (41 out of 46) occur in reserves spanning an array of geographic locations and habitats (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b). The species no longer meets the basic criteria for Survey and Manage in the WA Western Cascades Physiographic Province of the Mt. Baker-Snoqualmie National Forest and would be removed from the Survey and Manage Standards and Guidelines in this area under the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

### **Species that would Remain under Survey and Manage Standards and Guidelines**

Ten other species would remain under the Survey and Manage Standards and Guidelines as discussed below. Eight species would have the geographic range of application unchanged. These are *Arceuthobium tsugense* ssp. *mertensianae*, *Bensoniella oregana*, *Botrychium montanum*, *Coptis asplenifolia*, *Coptis trifolia*, *Corydalis aquae-gelidae*, *Eucephalus vialis*, and *Platanthera orbiculata* var. *orbiculata*. *Cypripedium fasciculatum* and *Cypripedium montanum* would have the application of the Survey and Manage Standards and Guidelines expanded to their entire ranges in the action alternatives compared to the No-Action Alternative.

*Bensoniella oregana* in California, *Botrychium montanum*, *Coptis asplenifolia*, *Coptis trifolia* and *Eucephalus vialis* are in Categories 1 and 2 under the No-Action Alternative and in Category 1A, 2A, and 3A under the action alternatives. Pre-disturbance surveys and management of known sites are required under all alternatives for these species. Strategic surveys also are required in the action alternatives. The requirement for strategic surveys is the only difference between the No-Action and the action alternatives. All of these species are known to have potential habitat in reserve land allocations that would not typically be subject to pre-disturbance surveys (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b). Strategic surveys conducted in these areas would provide a more accurate understanding of the abundance and distribution of these species and improve the opportunity for adaptive management but would not have any substantial effect on expected outcomes in the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge (effects of stochastic events and predictability of historic patterns of distribution), the management efforts identified for these species would provide sufficient habitat (including known sites) to allow them to stabilize in a pattern similar to their reference distribution in all of the alternatives except for *Eucephalus vialis*. *Eucephalus vialis* would stabilize in a pattern different from its reference distribution under all alternatives with the same level of uncertainty (due to lack of knowledge on historic patterns of distribution).

*Corydalis aquae-gelidae* and *Platanthera orbiculata* var. *orbiculata* are in Categories 1 and 2 under the No-Action Alternative and in Category 1C, 2D, and 3B under the action alternatives. *Corydalis aquae-gelidae* and *Platanthera orbiculata* var. *orbiculata* require the management of known sites in the No-Action Alternative, the management of known sites discovered on or before September 30, 1999, in Alternative 2, and the management of high-priority sites in Alternatives 1 and 3. Pre-disturbance surveys are required in the No-Action Alternative and Alternative 1. Equivalent-effort surveys are required under Alternative 3. Strategic surveys are required under the action alternatives and must be completed in 5 years under Alternative 2.

The ability of *Corydalis aquae-gelidae* and *Platanthera orbiculata* var. *orbiculata* to stabilize across their range would not be substantially affected by limiting management to high-priority

sites in Alternatives 1 and 3 and to sites discovered on or before September 30, 1999, in Alternative 2. *Corydalis aquae-gelidae* would not be substantially affected because of the moderate number (93) of extant sites (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b). *Platanthera orbiculata* var. *orbiculata* would not be affected because of the moderate to high likelihood of sites occurring in reserves (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b).

Pre-disturbance surveys for these species have been determined to be practical. Therefore, equivalent-effort surveys in Alternative 3 would have the same effect on these two species as pre-disturbance surveys in the other alternatives.

Strategic surveys would have no substantial effect on these species for the same reasons discussed above. Strategic surveys conducted in reserve allocations would provide a more accurate understanding of the abundance and distribution of these species and improve the opportunity for adaptive management but would not have any substantial effect on expected outcomes in the action alternatives.

Considering the effect of all of these factors on *Corydalis aquae-gelidae* and *Platanthera orbiculata* var. *orbiculata*, there is no substantial difference between the effects of the No-Action Alternative and the action alternatives. While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), all alternatives would provide sufficient habitat (including known sites) to allow both species to stabilize in a pattern similar to their reference distribution.

*Arceuthobium tsugense* ssp. *mertensianae* is in Category 4 under the No-Action Alternative and in Category 1F, 2D, and 3C under the action alternatives. Survey requirements for *Arceuthobium tsugense* ssp. *mertensianae* is limited to general surveys in the No-Action Alternative and strategic surveys in Alternative 1. Alternatives 2 and 3 also require the management of known sites. The majority of sites for this species occur in reserve land allocations and while there is a moderate level of uncertainty due to lack of knowledge (effect of stochastic events), all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution.

*Cypripedium fasciculatum* and *Cypripedium montanum* are in Categories 1 and 2 in the No-Action Alternative and Categories 1C, 2B, and 3B in the action alternatives. The action alternatives would expand the application of the Survey and Manage Standards and Guidelines to the entire geographic range for both species within the Northwest Forest Plan area.

*Cypripedium fasciculatum* and *Cypripedium montanum* require the management of known sites in the No-Action Alternative, the management of known sites discovered on or before September 30, 1999, in Alternative 2, and the management of high-priority sites in Alternatives 1 and 3. Pre-disturbance surveys are required in the No-Action Alternative and Alternative 1 and equivalent-effort surveys are required under Alternative 3. The action alternatives require strategic surveys (to be completed in 5 years under Alternative 2).

The ability of *Cypripedium fasciculatum* and *Cypripedium montanum* to stabilize across their range would not be substantially affected by limiting management to high-priority sites in Alternatives 1 and 3 and to sites discovered on or before September 30, 1999, in Alternative 2. Both species have a relatively high number of extant sites (908 sites for *C. fasciculatum* and 345 sites for *C. montanum*), have low to high numbers of individuals per site, and moderate to broad ecological amplitude (USDA, USDI 1998c and USDA, USDI Species Review Panel 1999b).

Pre-disturbance surveys for these species has been determined to be practical. Therefore, equivalent-effort surveys in Alternative 3 would have the same effect on these two species as pre-disturbance surveys in the other alternatives.

Strategic surveys would have no substantial effect on these species for the same reasons discussed above. Strategic surveys conducted in reserve allocations would provide a more accurate understanding of the abundance and distribution of these species and improve the opportunity for adaptive management but would not have any substantial effect on expected outcomes in the action alternatives.

Compared to the No-Action Alternative, *Cypripedium fasciculatum* and *Cypripedium montanum* would benefit from application of the Survey and Manage Standards and Guidelines throughout their entire range in the action alternatives. *Cypripedium fasciculatum* is known from the Cascades of Washington, Oregon, and California; the interior valleys of Oregon; and the Klamath Mountains of Oregon and California. *Cypripedium montanum* is known from the Cascades of Washington and Oregon; the interior valleys of Oregon; and the Klamath Physiographic Provinces of Oregon and California. Currently, the Survey and Manage Standards and Guidelines only apply to the Klamath Mountain Physiographic Province for *Cypripedium fasciculatum* and the west Cascades for *Cypripedium montanum*. Concerns in regard to long-term survival and maintaining stable and well-distributed populations were documented for both species throughout their respective ranges in the Northwest Forest Plan Final SEIS (58 percent to 92 percent chance of extirpation or restriction to refugia). While there is a moderate level of uncertainty due to lack of knowledge (predictability of historic patterns of distribution), applying the Survey and Manage Standards and Guidelines to the entire range of each species within the Northwest Forest Plan area in the action alternatives would improve the chances for both species to stabilize in a pattern similar to their reference distribution. In comparison, while there is a moderate level of uncertainty, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in patterns different than the reference distribution (USDA, USDI Species Review Panel 1999b).

## Arthropods

### Background and Affected Environment

Arthropods are invertebrates with jointed legs, a segmented body, and an exoskeleton (an external supporting covering). They include insects, crustaceans, arachnids, and myriapods. Collectively, arthropods constitute over 85 percent of the biological diversity in late-successional and old-growth forests in the Pacific Northwest (Asquith et al. 1990). Arthropods assume numerous ecological roles that are crucial to ecosystem function. Lattin (pers. comm.) estimates that there are between 20,000 and 25,000 described species of arthropods within the Northwest Forest Plan area, and as many more not yet described.

Arthropods inhabit virtually every part of the coniferous forest ecosystem, including coarse woody debris, litter and soil layers, understory vegetation, canopy foliage, tree trunks, snags, and the aquatic system. The litter and soil of the forest floor are the site of some of the greatest biological diversity found anywhere. The soil under a square yard of forest may hold as many as 250 species and 2 million individual mites from a single taxonomic group, as well as thousands of other mites, beetles, centipedes, pseudoscorpions, springtails, and spiders. Many of these species have not been described and most are poorly understood.

The structure and function of temperate forest soils are largely determined by the dietary habits of soil arthropods. They are the basic consumers of the forest floor where they ingest and process massive quantities of organic litter and debris, from large logs to bits of moss (Lattin and Moldenke 1992). While the richness of arthropod species in late-successional and old-growth forests suggests a great number of different processes and functions, relatively little is known about how arthropods interact, survive, and contribute to ecosystem function.

Arthropods in late-successional and old-growth forests are of concern for several reasons. First, many of the species are flightless, which means their dispersal capabilities are limited. In fact, little is known about the dispersal capabilities of these invertebrates. Second, their flightless

condition is believed to reflect habitat stability and permanence of a long period; therefore, they are susceptible to changes or disturbances to their habitat. Third, many of the old-growth forest associated species have disjunct distributions and are found only in undisturbed forests. They are often found only within the range of coniferous forests within the Pacific Northwest and are endemic to this area. Fourth, arthropods are key to ecosystem function and may serve as indicators of ecosystem health. They are: (1) a key element in the nutrient cycling of down logs; (2) major components in the litter and soil; (3) herbivores of the forest canopy; (4) pollinators of flowering plants; and, (5) play important roles in aquatic systems. Lastly, many of the species native to this region have not been described or named and the number of known species probably represents less than half of the number of species estimated to exist (Lattin and Moldenke 1992).

Survey efforts are currently underway to acquire additional information on community composition, abundance, and distribution, and to determine necessary levels of protection for the arthropod guilds included in Category 4 of the No-Action Alternative. The arthropod surveys use a predominantly research-based experimental approach form of strategic survey to examine the effects of disturbance (such as thinning and fire) on arthropod diversity and function. These disturbance effects were the primary concerns for arthropod persistence in the southern part of the region (California Physiographic Provinces and Oregon Klamath Physiographic Province) which includes most of the area where both natural and prescribed fire are a major concern. Researchers are now completing the second year of multiple-year studies.

## **Environmental Consequences and Comparison of Alternatives**

The Northwest Forest Plan Final SEIS identified the following four arthropod guilds as a concern: (1) litter and soil dwelling species; (2) coarse wood chewers; (3) understory and forest gap herbivores; and (4) canopy herbivores. All four of these guilds, in the south range, are assigned to Category 4, in the No-Action Alternative where only general regional surveys are required. The four arthropod guilds are assigned to Category 1F in Alternative 1, Category 2D in Alternative 2, and Category 3C in Alternative 3. Management would be similar across all alternatives in that only strategic surveys, similar to general regional surveys, would be required. The south range is defined as the Oregon Klamath, California Klamath, California Cascade, and California Coast Range Physiographic Provinces. The primary reason why arthropods were included in the Survey and Manage Standards and Guidelines was a concern that their ecological functions may not persist in the south range. Reasons for concern are because of the large number of endemic species with very limited ranges, potential for drought, significant risk of fire, patchy distribution of suitable habitats, and past management activities. Adequate studies of taxonomy, species distribution, and habitat dynamics are lacking. The intent of Survey and Manage is to acquire additional information on community composition, abundance, and distribution, and to determine appropriate levels of protection, not to specifically protect any species of arthropods. Known sites would not be managed under any alternative, including the No-Action Alternative.

The primary difference between the alternatives is that in Alternative 2, strategic surveys under Category 2D are to be completed in 5 years. This is insufficient time to determine necessary levels of protection from management practices such as forest thinning or prescribed fire. Plot-based, statistically designed experiments are expected to take 10 years to document whether the major species re-colonize disturbed sites and whether ecological functions return to normal levels. The No-Action Alternative, Alternative 1, and Alternative 3 do not require completion of the strategic surveys in 5 years and would allow the acquisition of the additional information needed to determine necessary levels of management.

The Northwest Forest Plan Final SEIS describes the effects on the four arthropod guilds of Alternative 9 that also are reflected as the expected effects of the No-Action Alternative in this SEIS. Since 1994, new information based on surveys of soil-dwelling beetles (Rappaport pers. comm.) indicates that a high percentage (at least 5-10 percent) of the arthropod fauna are newly discovered, suggesting that the degree of endemism may be greater than anticipated. For oribatid mites, prescribed fire always resulted in a meaningful change in community structure, but did not



always result in lower numbers or lower species diversity. It appears that moderately intense to very intense prescribed burns do result in a meaningful reduction in both individual numbers and species diversity; further survey work needs to be completed to validate this presumption. In summary, new information gathered since 1994 does not substantially alter the basic assumptions or conclusions of the Northwest Forest Plan Final SEIS that expressed a concern that their ecological functions may not persist in the south range. However, there continues to be insufficient information upon which to determine an outcome for these four guilds.

## Mollusks

### General Discussion

Mollusks represent a major part of the biological diversity in late-successional forests of the Pacific Northwest. Mollusk species associated with Northwest coniferous forests include land snails, aquatic snails, slugs, and clams. Mollusks may be found in a variety of habitat types. Land mollusks generally inhabit the forest litter and duff or low vegetation layers during suitably moist seasonal conditions. Many species require refugia such as large down wood, rocky outcrops, and moss-covered substrates that maintain relatively constant environmental conditions during cold or dry seasons. Some species (e.g. *Vertigo*) are primarily arboreal, while others (e.g. *Monadenia*) are partially arboreal and climb trees to forage, find suitable temporary cover, or escape from flooding. Local populations of slugs or snails are called colonies. Colonies vary from hundreds to tens of thousands of individuals, with colonies occupying areas ranging in size from tens to thousands of square feet.

As a group, mollusks are diverse in both the number of species and the roles they play in ecosystem functions. Some have restricted geographic ranges and narrow ecological requirements. Scientists are still discovering new, undescribed aquatic and terrestrial species in the Pacific Northwest and estimate that the known fauna may eventually double (Taylor 1981 and Frest and Johannes 1993). Approximately 350 species of mollusks are known to occur in forests within the range of the northern spotted owl (Frest and Johannes 1993).

Land snails and slugs account for more than 150 of the currently known fauna of about 350 species of mollusks. Most are found in moist forest environments and riparian areas near streams, springs, and seeps. Basalt and limestone talus outcrops are also important habitats for many species. Their present distribution has been influenced by a combination of geologic, hydrologic, climatic, and biotic history in the region. More than 100 mollusk species were identified as being associated with late-successional forests (USDA et al. 1993). Within the Northwest Forest Plan area, particularly in the Columbia Gorge, southwestern Oregon, and northwestern California, there are groups of mollusks that are endemic (found nowhere else). Concentrations of endemic species occur in the land snail genus *Monadenia*, the slug genus *Hemphillia*, and the aquatic snail genera *Fluminicola*, *Juga*, and *Lyogyrus*.

Most mollusks are herbivores, detritivores, and/or fungivores (Frest and Johannes 1993 and Roth 1993). By consuming leaf litter, terrestrial snails and slugs contribute to nutrient cycling and soil productivity. Two slug species (*Prophysaon coeruleum* and *P. dubium*) consume the fruiting bodies and hyphae of forest floor fungi, and disperse spores and hyphal fragments in their feces (Duncan et al. unpubl). A few terrestrial mollusk species consume animal matter and fecal material, and several species (e.g. *Ancotrema*) feed on other invertebrate species, including other mollusks. Small rodents, birds, and a variety of insects consume land snails and slugs (Frest and Johannes 1993 and Roth and Pressley 1986). Aquatic snails are herbivores and/or detritivores that feed on algae, bacteria, and fungi growing on rocks, wood, or submerged leaves (Brown 1991 and Frest and Johannes 1993). Furnish (1990) found that the aquatic snail *Juga silicula* can play a major role in consuming deciduous leaves that fall into streams and thereby contribute to nutrient cycling in aquatic ecosystems.

The number of known sites used throughout this section is based on data compiled in the Interagency Species Management System (ISMS) database. These data are a combination of the previous Known Sites database records and new information compiled from data supplied by field units in September 1998 and updated for surveys conducted during 1999. The ISMS database provides the most comprehensive and up-to-date site information for these species. However, some field units did not provide records during the latest data request so the ISMS records may not yet reflect the actual numbers of all known sites. This information was available to the Species Review Process panels as estimated numbers (without specific location or land allocation association) from agency responses to questionnaires.

Since the ISMS database was recently updated, the number of sites considered in the Species Review Process differed from some of the previous documents, such as draft Management Recommendations (Burke 1999 and USDA, USDI 1998d), or published research reports (Frest and Johannes 1997). The ISMS data represents the most recent available information on these species and is summarized in Table F-2.

For reasons relative to site management and species biology, the definition of a site or record for entry into the ISMS database varied by taxa group. For mollusks, separate sites are considered to be greater than 30 feet apart. For other species, the minimum distance between locations defining sites was 100 meters (see Appendix F). The number of mollusk records in the ISMS database was adjusted to be more comparable with other taxa during the Species Review Process. This did not have any influence regarding categorization of species.

The Survey and Manage Standards and Guidelines were applied to 43 mollusk species in the Northwest Forest Plan. All of these species were assigned to Categories 1 (manage known sites) and 2 (conduct surveys prior to habit-disturbing activities) in the Northwest Forest Plan ROD (Table C-3, pp. 59-60). The Protect from Grazing Standards and Guidelines were applied to 10 species in the Northwest Forest Plan ROD (p. C-6). *Pristiloma arcticum crateris*, *Fluminicola seminalis*, and *Fluminicola* n. spp. 1, 3, 11, 19, and 20 are included as both Survey and Manage and Protect from Grazing species. *Ancotrema voyanum*, *Monadenia fidelis klamathica*, and *M.f. ochromphalus* are Protect from Grazing species only. Field surveys, research, searches of museum collections, and monitoring accomplished under the Northwest Forest Plan have provided additional information for many of these species.

Additional known sites have been identified for 31 species since 1994; for 11 of these species the number of these sites has been increased by at least 100 percent. The distributions of new sites were also evaluated to determine whether any constituted extensions of known ranges. The new sites were interpreted as range extensions if collections were made in any National Forest or BLM District where the species was previously not known or expected to occur. This standard is based on known ranges and criteria for conditions triggering a survey for a particular species described in Table 1 of the draft Survey Protocols for aquatic and terrestrial Survey and Manage species (USDA, USDI 1998a and USDA, USDI 1998b). New records have resulted in an increase in the known ranges for 14 species. Conversely, less than 5 recent federal sites have been recorded for 11 species since 1994.

When analyzing the environmental consequences of alternative management strategies, the primary consideration was whether an alternative would provide for a reasonable assurance that a species would persist as stable populations across their historic ranges on federally managed lands. In a general sense, well-distributed means without significant gaps, sufficient to permit normal biological function and interactions between populations of the same species, considering life history characteristics and the habitats for which it is specifically adapted. The Survey and Manage mollusks all have limited powers of dispersal because of their relatively small body size and sedentary behavior. They are also commonly associated with restricted habitats that often have erratic distributions. For these species, well-distributed, stable populations must be interpreted in the context of the life history traits, the extent to which their historic distribution has been influenced by human-caused effects, and their ability to recolonize areas from which they have been excluded by disturbance events.

## Summary of Effects

The four alternatives have similar management actions: manage known sites; conduct pre-disturbance surveys; and conduct strategic surveys. No extensive or general regional surveys are required for any mollusk species in the No-Action Alternative. The provision for conducting strategic surveys under the action alternatives would increase the efficiency and effectiveness of species management in the future, by prioritizing and targeting surveys to address specific questions relative to management necessary for each species and by targeting surveys to suitable habitat.

Alternative 1 would remove pre-disturbance surveys for 11 mollusk species, and current management of known sites for *Monadenia churchi* and for *Megomphix hemphilli* south of the southern boundary of Benton, Lincoln, and Linn Counties, Oregon. Alternative 2 would remove pre-disturbance surveys for 13 mollusk species throughout their ranges, and for *Megomphix hemphilli* south of the southern boundary of Benton, Lincoln, and Linn Counties, Oregon. Alternative 2 would also remove management of known sites for three species (*Hemphillia glandulosa*, *H. malonei*, and *Monadenia churchi*) and for *Megomphix hemphilli* south of the southern boundary of Benton, Lincoln, and Linn Counties, Oregon. Alternative 3 would add pre-disturbance surveys for the three mollusk species previously only managed under the Protect from Grazing Standards and Guidelines (*Ancotrema voyanum*, *Monadenia fidelis klamathica*, and *M.f. ochromphalus*).

Under all action alternatives, two mollusks would be removed from the Survey and Manage Standards and Guidelines because of a high number of recent federal sites, broad habitat associations, and the likelihood of habitat in Late-Successional and Riparian Reserve land allocations. *Prophysaon coeruleum* is proposed for removal from Survey and Manage protection under all action alternatives within Oregon, but would remain in Category 1A in Alternative 1 in Washington and California. If records for *P. coeruleum* in Oregon are for a single, highly variable species, all alternatives would provide sufficient habitat (including known sites) for the species to stabilize in a pattern different from the reference distribution with a moderate level of uncertainty. However, if Oregon records for *P. coeruleum* represent a species complex, there is a high level of concern that it could suffer from habitat fragmentation, leading to loss of connectivity between populations and a serious threat to the continued existence of specific populations, or to one or more subsequently described species. While there is a moderate level of uncertainty due to unresolved taxonomic relationships between specimens recognized as this species, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern different from its reference distribution. Under the action alternatives, there is insufficient information regarding this species to determine how the action alternatives would affect distribution and stability.

*P. dubium* is proposed for removal throughout its range within the Northwest Forest Plan area. It is anticipated to have stable populations. The action alternatives would provide sufficient habitat (including known sites) to allow *P. dubium* to stabilize in a pattern different from its reference distribution while the No-Action Alternative would provide sufficient habitat (including known sites) to allow *P. dubium* to stabilize in a pattern similar to its reference distribution, all with a moderate level of uncertainty.

Under all alternatives, 36 mollusks would be expected to have an outcome of stable populations. All alternatives would provide sufficient habitat (including known sites) to allow eight species to stabilize in a pattern similar to their reference distributions with varying levels of uncertainty. All alternatives would provide sufficient habitat (including known sites) to allow 25 mollusk species to stabilize in a pattern different from their reference distributions either with a low or moderate level of uncertainty. Finally, all alternatives would provide sufficient habitat (including known sites) to allow 3 mollusk species to stabilize in a pattern similar to or different from their reference distributions with a moderate level of uncertainty.

For the remaining 10 mollusk species, there would be risk to stable populations that varies by alternative. In other words, it is anticipated that 10 mollusk species would have an unstable outcome in at least one alternative and at least a stable outcome in another alternative. Alternative 3 would provide adequate habitat (including known sites) to allow all 10 of these mollusk species to stabilize in a pattern similar to or different from their reference distributions with a moderate or high level of uncertainty, primarily due to the requirement for equivalent-effort pre-disturbance surveys. The No-Action Alternative would provide inadequate habitat (including known site) to maintain three Protect from Grazing species (*Ancotrema Voyanum*, *Monadenia fidelis klamathica*, and *M.f. ochromphalus*) because of the lack of pre-disturbance surveys and strategic surveys. Alternative 1 would provide habitat (including known sites) insufficient to support stable populations of these 10 species. Eight rare species are at risk to stability because of the lack of pre-disturbance surveys. Two uncommon species are considered at risk to stability because management of all known sites and pre-disturbance surveys would not be conducted. Alternative 2 would provide habitat (including known sites) insufficient to support stable populations for eight of these 10 mollusk species because of the lack of pre-disturbance surveys.

## Mollusk Species to Remain Under Survey and Manage Standards and Guidelines

Environmental consequences for each alternative vary depending on the management proposed and the biological attributes of each species. To simplify the analysis and presentation of environmental consequences, the 46 mollusk taxa have been organized into five groups based on the management categories described in Chapter 2. In addition, separate discussions are presented for the two mollusk species proposed for removal from the Survey and Manage Standards and Guidelines under the action alternatives.

*Cryptomastix devia*, *C. hendersoni*, *Helminthoglypta talmadgei*, *Hemphillia burringtoni*, *Megomphix hemphilli* (north of the southern boundary of Lincoln, Benton, and Linn Counties, Oregon), *Monadenia fidelis minor*, *M. troglodytes troglodytes*, *M. troglodytes wintu*, *Oreohelix* n. sp., *Prophysaon coeruleum* (in Washington and California), *Trilobopsis roperi*, *T. tehamana*, *Vertigo* n. sp., *Vespericola pressleyi*, *V. shasta*, *Fluminicola seminalis*, *Fluminicola* n. spp. 1, 2, 3, 11, 14, 15, 16, 17, 18, 19, and 20, *Juga* n. spp. 2 and 3, and *Lyogyrys* n. spp. 1, 2, and 3

### Background and Affected Environment

This group includes 32 taxa (species and subspecies, including 2 species in parts of their ranges); 15 are terrestrial and 17 are aquatic. The terrestrial species are: *Cryptomastix devia*, *C. hendersoni*, *Helminthoglypta talmadgei*, *Hemphillia burringtoni*, *Megomphix hemphilli* (north of the southern boundary of Lincoln, Benton, and Linn Counties, Oregon), *Monadenia fidelis minor*, *M. troglodytes troglodytes*, *M. t. wintu*, *Oreohelix* n. sp., *Prophysaon coeruleum* (in Washington and California), *Trilobopsis roperi*, *T. tehamana*, *Vertigo* n. sp., *Vespericola pressleyi*, and *V. shasta*. The aquatic species are: *Fluminicola seminalis*, *Fluminicola* n. spp. 1, 2, 3, 11, 14, 15, 16, 17, 18, 19, and 20, *Juga* n. spp. 2 and 3, and *Lyogyrys* n. spp. 1, 2, and 3.

This group is generally characterized by species that have limited known ranges and/or a low number of known sites. There is a high concern that the species within this group could experience a loss of connectivity and that populations could become restricted to refugia, that some populations might be lost, or that the continued existence of the species might be threatened. Some of these species already occur in disjunct or widely separated populations due to the naturally scattered and unpredictable distribution of suitable habitats or historic human-caused effects. In the case of isolated populations, the size of the habitat area becomes a concern since it must provide a fully functioning ecosystem sufficient to support stable populations of these species over the long-term. Pre-disturbance survey efforts since 1994 have increased the number of known sites for most of these species (see Table F-2) and, for some, this new information indicates that they occupy a larger range than was known when the Northwest Forest Plan ROD

was published. Although additional habitat data have been collected during pre-disturbance surveys and knowledge of habitat requirements has improved, habitat associations for these species remain poorly understood.

Information on both geographic and reference distributions is fragmentary or entirely unavailable for all of the species in this group because historically, collections were undertaken in limited geographic areas and a majority of the Survey and Manage mollusk species were undiscovered or unrecognized as distinct species until recently. The suspected overall geographic ranges and distributions within those ranges for this group are described below, based on the limited amount of available information.

*Megomphix hemphilli*, north of the south boundary of Benton, Lincoln, and Linn Counties, Oregon, has a widespread overall geographic range but it is spotty in Oregon and limited to a small portion of its range in Washington. *Fluminicola* n. spp. 3, 11, 14, 17, and 18 have an unknown geographic range and their distribution within their range is also unknown. *Lyogyrus* n. sp. 2 and *Juga* (*Oreobasis*) n. sp. 3 have an unknown geographic range and their distribution within their range is limited. *Fluminicola* n. spp. 1, 2, 15, 16, 19, and 20, *Vertigo* n. sp., *Juga* (*Oreobasis*) n. sp. 2, and *Lyogyrus* n. sp. 1 and 3 have an unknown geographic range and their distributions within their ranges are limited to a small portion. *Cryptomastix devia* has a moderate overall geographic range and its distribution within that range is widespread and even. *Helminthoglypta talmadgei* and *Hemphillia burringtoni* have a moderate overall geographic range and their distribution within their ranges is widespread, but spotty. *Cryptomastix hendersoni* and *Monadenia fidelis minor* have overall limited geographic ranges and their distribution within their ranges are limited to a small portion. *Fluminicola seminalis* has an overall limited geographic range and its distribution within that range is limited. *Oreohelix* n. sp. has an overall limited geographic range and its distribution within that range is widespread, but spotty. *Monadenia troglodytes troglodytes* and *Prophysaon coeruleum*, in Washington and California, have very limited overall geographic ranges and their distribution within their ranges is limited to a small portion. *Trilobopsis roperi*, *Vespericola pressleyi*, and *Vespericola shasta* have very limited overall geographic ranges and their distributions within their ranges is limited throughout. *Trilobopsis tehamana* has a very limited overall geographic range and its distribution within that range is limited to a small portion. *Monadenia troglodytes wintu* has an extremely limited overall geographic range and its distribution within that range is limited to a small portion.

The assumed reference distribution is based upon presently known species distributions and the proximity of potentially suitable habitat according to historic records, elevation, climate, and potential natural vegetation. The following information provides some characterization of what the reference distribution of the species in this group is believed to be.

For the following species, there is a moderate level of uncertainty due to limited information and lack of knowledge about their suitable habitat and dispersal capabilities. *Fluminicola* n. spp. 1, 2, 3, and 20 are thought to occur in isolated sites. *Vertigo* n. sp., *Trilobopsis tehamana*, *Cryptomastix hendersoni*, and *Lyogyrus* n. sp. 2 are thought to occur in isolated site clusters. *Oreohelix* n. sp., *Hemphillia burringtoni*, *Fluminicola seminalis*, *Monadenia fidelis minor*, *Megomphix hemphilli* (north of the south boundary of Lincoln, Benton, and Linn Counties, Oregon), *Monadenia troglodytes troglodytes* and *M. t. wintu* are thought to occur in multiple sites and/or clusters with limited connectivity. *Cryptomastix devia* is thought to occur in sites and clusters with multiple avenues of connectivity.

For the following species, there is a high level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities. *Fluminicola* n. spp. 16, 18, and 19, *Juga* (*Oreobasis*) n. sp. 3, and *Lyogyrus* n. spp. 1 and 3 are thought to occur in isolated sites. *Fluminicola* n. sp. 15 and *Juga* n. sp. 2 are thought to occur in isolated site clusters. *Helminthoglypta talmadgei*, *Prophysaon coeruleum* in Washington and California, *Vespericola pressleyi*, and *V. shasta* are thought to occur in multiple sites and/or clusters with limited connectivity.

So little historical information is available on the distribution of *Flumicola* n. spp. 11, 14, and 17 that the reference distribution of these species is considered to be unknown.

### Environmental Consequences and Comparison of Alternatives

This group is composed of rare species for which pre-disturbance surveys are considered practical, and are categorized into Category 1A in Alternative 1, 2A in Alternative 2, and 3A in Alternative 3 (see Table 2-2). For all alternatives, known sites would be managed and surveys would be conducted prior to habitat-disturbing activities. Under the action alternatives, strategic surveys would be added. Extensive or general regional surveys are not required under the No-Action Alternative. Strategic surveys would provide useful information on distribution and habitat information needs because they would be concentrated in areas of suitable habitat rather than areas where disturbance from management activities is anticipated. This would result in a more comprehensive application of the management strategies and better ensure stability of the species.

There is a slight difference in the manner in which known sites would be managed under Alternative 3 compared to the other alternatives. Under Alternative 3, all known sites would be protected with a 250-meter buffer (minimum 48.5 acres). Under the other alternatives, mitigation is variable depending on the Management Recommendations for each species which consider environmental needs, life history traits, and site conditions. However, known sites are managed with the objective of providing for the persistence of the taxon at each site. As a general rule, a fixed 250-meter buffer around a known site should be equal to or better than mitigation provided under the Management Recommendations in preserving the suitability of the site for a given species. This is because a 250-meter buffer would be sufficient to maintain microhabitat characteristics, especially moisture which is important for terrestrial mollusks (USDA et al. 1993, Figure V-13 and Roth 1993).

The likelihood that members of this group would maintain stable populations would be similar for each alternative because management of all known sites and pre-disturbance surveys would continue. The action alternatives would result in a slightly greater assurance than the No-Action Alternative that these species would remain stable because they require strategic surveys. Strategic surveys would: (1) enhance the chances that additional known sites would be discovered, providing a more thorough basis for defining habitat requirements; (2) evaluate the effectiveness of designated reserves in providing sufficient habitat to protect the species; and, (3) help determine the most appropriate management to support stable populations. Strategic surveys may also provide information that could be valuable in understanding life history traits, and in selecting high-priority sites for management should any of these species be recategorized as uncommon based on finding an appropriate number of sites during future surveys.

While there is a moderate level of uncertainty primarily due to lack of knowledge about the historic and current distributions, and habitat associations for all of these species, all alternatives would provide sufficient habitat (including known sites) to allow the following species to stabilize in patterns similar to their reference distributions: *Flumicola* n. spp. 1, 2, 3, and 14.

While there is a moderate level of uncertainty primarily due to lack of knowledge about the historic and current distributions and habitat associations for these species, all alternatives would provide habitat (including known sites) sufficient to allow the following species to stabilize in a pattern different from their reference distribution: *Cryptomastix devia*; *C. hendersoni*; *Flumicola* n. spp. 15, 16, 17, 18, 19, and 20; *Flumicola seminalis*; *Helminthoglypta talmadgei*; *Juga (Oreobasis)* n. spp. 2 and 3; *Lyogyrus* n. spp. 1, 2, and 3; *Monadenia fidelis minor*; *M. troglodytes troglodytes*; *M. t. wintu*; *Prophysaon coeruleum* (in Washington and California); *Vespericola pressleyi*; and *V. shasta*.

There is a low level of uncertainty that all alternatives would provide sufficient habitat (including known sites) to allow *Vertigo* n. sp. to stabilize in a pattern similar to its reference distribution. All alternatives would also provide habitat (including known sites) sufficient to allow the northern populations of *Megomphix hemphilli* (north of the southern boundary of Lincoln, Benton, and

Linn Counties, Oregon) to stabilize in a pattern different from its reference distribution, with a low level of uncertainty.

While there is a moderate level of uncertainty primarily due to lack of knowledge about the historic and current distributions and habitat associations for *Oreohelix* n. sp., the No-Action Alternative would provide habitat (including known sites) sufficient to allow this species to stabilize in a pattern different from its reference distribution. However, Alternatives 1, 2, and 3 would provide sufficient habitat (including known sites) to allow *Oreohelix* n. sp. to stabilize in a pattern similar to its reference distribution.

For *Fluminicola* n. sp 11, while there is a low level of uncertainty for the No-Action Alternative and Alternative 3, and a moderate level of uncertainty for Alternatives 1 and 2, every alternative would provide habitat (including known sites) sufficient to allow it to stabilize in a pattern different from its reference distribution. The moderate level of uncertainty associated with Alternatives 1 and 2 is due to a lack of knowledge about the historic and current distributions and habitat associations.

For *Trilobopsis roperi* and *Hemphillia burringtoni*, while there is a moderate level of uncertainty primarily due to lack of knowledge about the historic and current distributions and habitat associations, the No-Action Alternative and Alternatives 1 and 2 would provide habitat (including known sites) sufficient to allow these species to stabilize in a pattern different from their reference distributions. Alternative 3 would provide sufficient habitat (including known sites) to allow them to stabilize in a pattern similar to their reference distributions, also with a moderate level of uncertainty.

Finally, while there is a high level of uncertainty due to lack of knowledge about the historic and current distributions and habitat associations, the No-Action Alternative and Alternatives 1 and 2 would provide sufficient habitat (including known sites) to allow *Trilobopsis tehamana* to stabilize in a pattern similar to its reference distribution. Alternative 3 would result in the same outcome, but with a moderate level of uncertainty.

***Deroceras hesperium*, *Helminthoglypta hertleini*, *Hemphillia pantherina*, *Monadenia fidelis klamathica*, *Monadenia chaceana*, *Monadenia fidelis ochromphalus*, and *Pristiloma arcticum crateris***

### **Background and Affected Environment**

This group consists of seven terrestrial species. Species in this category are considered rare and pre-disturbance surveys are considered not practical. Standards used to define whether surveys for specific species are practical are described in Chapter 2. The factors that pertain to these species relate to the inability of field personnel to authoritatively identify specimens as specific Survey and Manage taxa. This may be because they are: (1) difficult to distinguish from similar, undescribed species; (2) very small and the diagnostic characteristics are difficult to perceive and/or highly variable; or, (3) very rare and lack either dependable descriptions or voucher specimens for comparison. An additional factor that complicates survey efforts for *Pristiloma arcticum crateris* is that special survey techniques, such as extraction from leaf litter samples or arboreal searches, are required (USDA, USDI 1998b).

Four of the species in this category (*Helminthoglypta hertleini*, *Monadenia chaceana*, *M. fidelis klamathica*, and *M. f. ochromphalus*) have limited ranges, few known sites, and are difficult to authoritatively identify without verification by an expert (Table F-2). At times, even experts disagree on the identity of specimens for these species. This difficulty is primarily the result of the non-quantitative nature of the characteristics used to distinguish these species from other, closely related taxa found within their ranges. Characteristics such as more rounded, “shiny vs. smooth and polished,” or “irregular vs. light malleation” are used to distinguish between similar taxa. Without type specimens available in museums or verified voucher specimens, it is often difficult to make credible identifications. Some *Monadenia* species may also interbreed with other species

of the same genus and the result is a continuum of nearly indistinguishable characteristics (Roth and Pressley 1986). Surveyors usually are able to identify typical specimens of the taxa in this category. Accurate identifications of specimens with characteristics intermediate between two or more similar taxa requires an expert who is familiar with the inherent variability within populations of a species. In addition, locality information for a new specimen is customarily compared with the known range of a taxon and this information is used to help in species identification. Ranges for these species are still poorly known, and range information is of limited use in cases where new geographic areas (i.e. outside the known range) are surveyed. In conclusion, in many cases these species require expert verification of specimens. Until verified voucher specimens and improved knowledge of variability within a species are available to surveyors, it is not practical to survey for any of these species.

In spite of these difficulties, 6 additional sites for *Helminthoglypta hertleini* have been discovered since 1994 bringing the total number of known sites to 16. Since 1994, known sites for *Monadenia chaceana* have approximately tripled to a total of 48 current federal sites. There are currently eight known sites for *Monadenia fidelis klamathica*. Known sites for *M. fidelis ochromphalus* have increased in number from 30 to 65. Two of the species in this category, *Deroceras hesperium* and *Hemphillia pantherina*, appear to be particularly rare. *D. hesperium* has rarely been found in the past decade. Two new sites have been recorded since 1994 bringing the total known sites in the ISMS database to five. Published descriptions and illustrations are available (Pilsbry 1939 and 1948, and USDI 1999), but verified reference specimens are not available and no photographs exist. Consequently, without comparative material or good images for reference and training, this species is difficult to recognize in the field, and may be easily overlooked or mistaken for another species of the same genus. *Hemphillia pantherina* is known from a single specimen (Branson 1975), and its occurrence at the type locality has not been reconfirmed since the type specimen was collected. Repeated visits to the type locality have failed to relocate this species. However, similar species of the same genus have been found on several occasions.

The remaining species in this category, *Pristiloma arcticum crateris*, may be difficult to locate and identify in the field because of its small size and cryptic habits. There are 13 known sites in the ISMS database for this species; five have been verified by taxa experts. Since it is very small (2.75 mm or less diameter), it may be overlooked during typical surveys unless the observer is familiar with species in this genus. Leaf litter samples may be collected and processed or individual leaves and pieces of bark may be inspected with a hand lens to discover possible specimens (USDA, USDI 1998b). These must then be examined under magnification in order to make a positive identification and, as with the species described above, shell characteristics utilized to make identifications are qualitative and access to comparative material is essential. In addition, the specific characteristics used to identify this species are only developed in adult specimens, so it may not be possible to distinguish immature specimens from other, similar appearing species.

Information on both geographic and reference distributions is fragmentary or entirely unavailable for all of the species in this group. Historically, collections were undertaken in limited geographic areas and a majority of the Survey and Manage mollusk species were undiscovered or unrecognized as distinct species until the last few years. The suspected overall geographic ranges and distributions within those ranges for this group are described below, based on the limited amount of available information.

*Deroceras hesperium* has a widespread overall geographic range and its distribution within that range is widespread, but spotty. *Monadenia chaceana* has a moderate overall geographic range and its distribution within that range is widespread, but spotty. *Helminthoglypta hertleini* and *Monadenia fidelis ochromphalus* have limited overall geographic ranges and their distribution within their ranges is widespread, but spotty. *Pristiloma arcticum crateris* has a limited overall geographic range and its distribution within that range is limited throughout. *Monadenia fidelis*



*klamathica* has a very limited overall geographic range and its distribution within that range is widespread, but spotty. *Hemphillia pantherina* has an extremely limited overall geographic range and its distribution within that range is limited to a small portion.

An assumption of reference distribution was made based upon presently known species locations and the proximity of suitable habitat according to historic records, elevation, climate, and potential natural vegetation. The following information provides some characterization of what the reference distribution of these species is believed to be.

For the following species, there is a moderate level of uncertainty due to limited information and lack of knowledge about their suitable habitat and dispersal capabilities. *Pristiloma articum crateris* is thought to occur in isolated site clusters. *Monadenia fidelis klamathica* and *M.f. ochromphalus* are thought to occur in multiple sites and/or clusters with limited connectivity.

For the following species, there is a high level of uncertainty due to limited information and lack of knowledge about their suitable habitat and dispersal capabilities. *Hemphillia pantherina* is thought to occur in isolated sites. *Deroceras hesperium*, *Helminthoglypta hertleini*, and *Monadenia chaceana* are thought to occur in multiple sites and/or clusters with limited connectivity.

### Environmental Consequences and Comparison of Alternatives

This group is composed of rare species for which pre-disturbance surveys are considered impractical, and are included in Categories 1B in Alternative 1, 2B in Alternative 2, and 3A in Alternative 3. Under the No-Action Alternative, *Deroceras hesperium*, *Helminthoglypta hertleini*, *Hemphillia pantherina*, and *Monadenia chaceana* are Category 1 and 2 species under the Survey and Manage Standards and Guidelines which requires managing known sites and conducting pre-disturbance surveys. *Monadenia fidelis klamathica* and *M.f. ochromphalus* are Protect from Grazing species under the No-Action Alternative, which requires protection of known and newly discovered sites from impacts due to grazing. *Pristiloma articum crateris* is both a Survey and Manage species in Categories 1 and 2, and a Protect from Grazing species. Management under Alternatives 1 and 2 would be similar for all species in this group and include management of all known sites and implementation of strategic surveys to most efficiently find new sites and characterize habitats for these species. Under Alternative 3, known sites would be protected by a 250-meter buffer and with a slightly different objective for strategic surveys, which would be focused on the ability of the reserves to provide for important habitat and species stability. Also, equivalent-effort, pre-disturbance surveys would be required.

Since pre-disturbance surveys are not required in the No-Action Alternative and Alternatives 1 and 2 for the two *Monadenia fidelis* subspecies, there is a potential for inadvertent loss of undetected sites. Pre-disturbance surveys for species in this category are considered not practical. Surveys prior to habitat-disturbing activities have had limited success in locating and identifying these species due to the reasons discussed above. However, discovery of a few new locations would be expected during equivalent-effort, pre-disturbance surveys. Known sites are currently isolated from each other and all sites are considered critical to the stability of each species. Since there are so few known sites for these species, loss of any occupied habitat area would be cause for concern for the species stability. Under the No-Action Alternative and Alternatives 1 and 2, a few new sites may also be discovered incidentally during pre-disturbance surveys for other species. Sites discovered in project areas (either incidentally during pre-disturbance surveys for other species or through equivalent-effort, pre-disturbance surveys) would likely be isolated from each other due to the scattered locations of proposed projects. As a result, the pattern of information used to characterize population distribution would most likely remain disjunct.

Strategic surveys, required under all of the action alternatives, may be more likely to result in an increase in known sites than pre-disturbance surveys, due to the use of specially trained surveyors and focusing searches in areas considered to have the most suitable habitat. These strategic

surveys could also be concentrated in areas between the existing populations. New site locations would help to increase knowledge related to connectivity and result in a greater degree of stability. The efficiency of strategic surveys and the degree of effort spent implementing them, compared to that spent in pre-disturbance surveys, will be proportional to the ability of these methods to locate new sites and maintain connectivity. Alternatives 1 and 2 have the added benefit of minimizing inadvertent loss of undiscovered sites by not implementing projects in old-growth habitat after 2006 in those physiographic provinces where strategic surveys have not been completed. Alternative 3 would result in the highest degree of stability of these species because it would provide equivalent-effort, pre-disturbance surveys, management of known sites, and strategic surveys. The two species currently managed as Protect from Grazing species (*Monadenia fidelis* subspecies) would receive the greatest benefit from all action alternatives due to the addition of known site management and strategic surveys. Alternative 3 would provide the greatest benefit of all alternatives because additional sites and knowledge should be gained from equivalent-effort and strategic surveys.

For five of these species (*Deroceras hesperium*, *Helminthoglypta hertleini*, *Hemphillia pantherina*, *Monadenia chaceana*, and *Pristiloma arcticum crateris*), the requirement to manage known sites is maintained under all four alternatives. For the two *Monadenia fidelis* subspecies, known sites are protected from grazing only under the No-Action Alternative. Under the action alternatives, known sites would be managed and strategic surveys would be conducted. Areas designated to maintain site conditions are expected to be smaller under the No-Action Alternative and Alternatives 1 and 2 than those required under Alternative 3. The likelihood that site conditions and habitat quality would be maintained are greatest under Alternative 3 because managing a larger habitat area would minimize the detrimental reduction of available moisture resulting from greater exposure to wind and sunlight. The 250-meter buffers under Alternative 3 also have the advantage of best ensuring that connectivity within and between populations is maintained by protecting a greater number of acres of suitable habitat across the landscape.

In conclusion, while there are various levels of uncertainty associated with projected outcomes due to a lack of knowledge regarding the current distribution and abundance, the following outcomes would be expected.

For *Pristiloma arcticum crateris*, while there is a moderate level of uncertainty, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution. While there is a moderate level of uncertainty, Alternative 1 would provide inadequate habitat (including known sites) to maintain the species. While there is a high level of uncertainty, Alternative 2 would provide inadequate habitat (including known sites) to maintain the species. While there is a low level of uncertainty, Alternative 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

For *Deroceras hesperium*, while there is a high level of uncertainty under every alternative, the No-Action Alternative and Alternative 3 would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from its reference distribution. Alternatives 1 and 2 would provide inadequate habitat (including known sites) to maintain the species.

For *Hemphillia pantherina*, while there is a moderate level of uncertainty, the No-Action Alternative and Alternative 3 would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from its reference distribution. Alternatives 1 and 2 would provide inadequate habitat (including known sites) to maintain the species, with a high level of uncertainty.

For *Helminthoglypta hertleini*, while there is a moderate level of uncertainty for all alternatives, the No-Action Alternative would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different for its reference distribution. Alternatives 1 and 2 would

provide inadequate habitat (including known sites) to maintain the species. Alternative 3 would provide habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

For *Monadenia chaceana*, while there is a moderate level of uncertainty, the No-Action Alternative and Alternative 3 would provide habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution. Alternatives 1 and 2 would provide inadequate habitat (including known sites) to maintain the species, with a high level of uncertainty.

For the two Protect from Grazing species, *Monadenia fidelis klamathica* and *M. f. ochromphalus*, there is a lack of information on their current distributions because surveys have not been required and these species are susceptible to a loss of connectivity. They appear to be rare and loss of any occupied sites could further threaten their existence. Sites discovered incidentally for these species since 1994 have revealed that they occur in habitats where grazing is not the only source of disturbance that could represent a threat to their stability and distribution. While there is a moderate level of uncertainty under every alternative, the No-Action Alternative, and Alternatives 1 and 2 would provide inadequate habitat (including known sites) to maintain these two species. Alternative 3 would provide sufficient habitat (including known sites) to allow each species to stabilize in a pattern different from its reference distribution.

### ***Hemphillia glandulosa* and *Hemphillia malonei***

#### **Background and Affected Environment**

These two terrestrial species are varieties of jumping slugs. Based on pre-disturbance surveys, both *Hemphillia glandulosa* and *H. malonei* are more common than previously thought. Prior to 1994, both species were known from less than 10 sites. Although they have both been collected from at least 100 sites, they are still considered uncommon. Pre-disturbance surveys have confirmed that *H. glandulosa* occurs throughout its historic range in Washington from the Olympic Peninsula and Willapa Hills to the western Cascade Range as far north as King County. In Oregon, pre-disturbance surveys have confirmed that it occurs in the Coast Range (previously reported by Branson and Branson 1984), and it appears to be fairly common in the Hebo Ranger District of the Siuslaw National Forest. External characteristics used to distinguish *H. glandulosa* from *H. burringtoni* merge between the species so identification is not always certain (Burke 2000, pers. comm.). Pre-disturbance surveys since 1994 have extended the known range of *H. malonei* north of the Columbia River Gorge into the Cascade Range and Olympic Peninsula as far north as the Capitol State Forest in Thurston County, Washington. The Washington specimens of *H. malonei* are darker than the typical specimens occurring in Oregon and may be an undescribed species or subspecies (Burke 2000, pers. comm.). If the two geographic color variations of *H. malonei* are actually two different species, the number of known sites and range of *H. malonei* would be reduced. The taxonomic difficulties for both species create an element of uncertainty in data on range, number of sites, and habitat associations. Pre-disturbance surveys are deemed practical.

An assumption of reference distribution was made based upon presently known species locations and the proximity of suitable habitat according to historic records, elevation, climate, and potential natural vegetation. Although there is a moderate level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Hemphillia glandulosa* and *H. malonei*, they occur in multiple sites and/or clusters with limited connectivity. *Hemphillia glandulosa* has a widespread overall geographic range and its distribution is limited throughout its range. *Hemphillia malonei* has a limited overall geographic range, and its distribution is limited throughout its range.

#### **Environmental Consequences and Comparison of Alternatives**

*Hemphillia glandulosa* and *Hemphillia malonei*, are assigned to Category 1C in Alternative 1, 2D in Alternative 2, and 3B in Alternative 3 (see Table 2-2). In the No-Action Alternative, both

species are in Categories 1 and 2, which require management of known sites and pre-disturbance surveys. Management of known sites would continue for these two species under all alternatives. Under Alternative 2, only sites known as of September 30, 1999, would be managed. Under Alternatives 1 and 3, high-priority sites would be selected and managed. Pre-disturbance surveys would continue under all alternatives except Alternative 2. As a result, Alternative 2 places both species at an increased risk of inadvertent loss of sites. All of the action alternatives require strategic surveys while the No-Action Alternative does not. Strategic surveys provide a more thorough basis for: (1) defining habitat requirements; (2) evaluating the effectiveness of designated reserves in providing sufficient habitat to protect the species; (3) determining the most appropriate management strategies to support stable populations; and, (4) determining high-priority sites for management. Alternative 2 differs from Alternatives 1 and 3 because strategic surveys would be completed in 5 years. At that time, based on the information gathered, each species would be considered for inclusion in the Agencies' Special Status Species programs or removed from special management consideration if no additional species-specific provisions are considered necessary.

For comparison, the No-Action Alternative would manage all currently known sites and sites discovered during pre-disturbance surveys. Alternatives 1 and 3 would manage a sub-set of these sites, as well as those located during strategic surveys that would be designated as high-priority sites. Alternative 2 would manage only those sites known as of September 30, 1999. The number and distribution of high-priority sites necessary to maintain sufficient connectivity for stable populations is uncertain. However, such a selection process is likely to result in a more functional pattern of distribution of populations and habitat than the pattern represented by sites known as of September 30, 1999, since most of these sites were located during pre-disturbance surveys and are concentrated in a relatively few, scattered project locations.

In conclusion, while there is a moderate level of uncertainty due to a lack of knowledge about current distribution, habitat requirements, and taxonomic affinities for these species, the No-Action Alternative and Alternatives 1 and 3 would provide habitat (including known sites) sufficient to allow each species to stabilize in a pattern different from its reference distribution. Alternative 2, while there is a high level of uncertainty, would also provide sufficient habitat (including known sites) to allow these species to stabilize in a pattern different from their reference distribution.

### ***Ancotrema voyanum*, *Vorticifex klamathensis sinitsini*, and *Vorticifex* n. sp. 1**

#### **Background and Affected Environment**

These three species are characterized by having limited known ranges and/or occurrence at a low number of known sites. In spite of pre-disturbance survey efforts and contracted surveys within the range of these species (Frest and Johannes 1996a, 1996b, and 1997), new sites have only been identified for *Ancotrema voyanum* (26 recent federal sites by incidental discovery) since the Northwest Forest Plan ROD. No recent federal sites have been found for the other two species. These species were assigned to this group because of their limited distribution and abundance and unresolved questions about whether they are associated with old-growth habitats. Pre-disturbance surveys are considered practical for all three of these species.

*Vorticifex klamathensis sinitsini*, and *Vorticifex* n. sp. 1 are aquatic species. *Vorticifex klamathensis sinitsini* occurs in large, cold springs with coarse substrate and with macrophytes (visible plants) generally present. It is known from several sites in the vicinity of Upper Klamath Lake, Klamath County, Oregon, and any substantial range extension is unlikely (Frest and Johannes 1999a). *Vorticifex* n. sp. 1 occurs on rocky substrate in flowing water in a large, pristine spring complex. It is known from two sites in Shasta County, California, and a limited number of additional sites are suspected to occur in the Shasta National Forest (Frest and Johannes 1999c).

*Ancotrema voyanum* is a terrestrial species and is under the Protect from Grazing Standards and Guidelines in the Northwest Forest Plan. It occurs in Trinity, Shasta, and Humboldt Counties,

California. Its habitat is generally in forested areas with permanently damp or moist soil (USDI 1999). Several new sites have been discovered since implementation of the Northwest Forest Plan, and as a result, the known range has been extended approximately 30 miles to the north and 20 miles to the east. However, the total number of known sites, approximately 34, remains low.

Information on both geographic and reference distributions is fragmentary or entirely unavailable for these species because historically, collections were undertaken in limited geographic areas and a majority of the Survey and Manage mollusk species were undiscovered or unrecognized as distinct species until the last few years. However, an assumption of reference distribution was made based upon presently known species distributions and the proximity of suitable habitat according to historic records, elevation, climate, and potential natural vegetation. The following information provides some characterization of the suspected reference distribution for these species.

Although there is a moderate level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Vorticifex klamathensis sinitsini* and *Vorticifex* n. sp. 1, they occur in isolated sites.

Although there is a high level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Ancotrema voyanum*, it occurs in multiple sites and/or clusters with limited connectivity.

The suspected geographic ranges and distributions within those ranges for these species are identified below.

*Ancotrema voyanum* has a limited overall geographic range and its distribution within this range is widespread, but spotty.

*Vorticifex klamathensis sinitsini* and *Vorticifex* n. sp. 1 have extremely limited overall geographic ranges and their distribution is limited to a small portion of their ranges.

### **Environmental Consequences and Comparison of Alternatives**

These three species are assigned to Category 1E under Alternative 1, Category 2C under Alternative 2, and Category 3A under Alternative 3 (see Table 2-2). Under the No-Action Alternative, *Ancotrema voyanum* is a Protect from Grazing species. *Vorticifex klamathensis sinitsini* and *Vorticifex* n. sp. 1 are Category 1 and 2 species. Extensive or general regional surveys are not required under the No-Action Alternative; however, management of known sites and pre-disturbance surveys are required for the two *Vorticifex* species and sites occupied by *Ancotrema voyanum* are protected from grazing. Under Alternatives 1 and 2, all known sites would be managed and strategic surveys would be conducted. Under Alternative 3, known sites would be managed with a 250-meter buffer and equivalent-effort, pre-disturbance surveys and strategic surveys would be conducted.

The likelihood that these species would maintain their currently known abundance and distributions would be similar under all alternatives because management of all known sites would continue for the *Vorticifex* species and be added for *Ancotrema voyanum*. Alternatives 1, 2, and 3 would result in a greater assurance that these species would remain stable throughout their range within the Northwest Forest Plan area because they require strategic surveys. Strategic surveys could provide information to more accurately describe their ranges and habitat needs. This is most apparent for *A. voyanum* because under the No-Action Alternative, no surveys are required and its habitat is merely protected from grazing, not from other disturbances. For the two *Vorticifex* species, strategic surveys would be advantageous because surveys would be concentrated in areas of most suitable habitat. This approach would enhance the chances of discovering additional occupied sites, thereby providing a more thorough basis for: (1) defining habitat requirements; (2) evaluating the effectiveness of designated reserves in providing sufficient habitat to protect the species; and, (3) determining the most appropriate management to support stable populations. The

No-Action Alternative and Alternative 3 would require pre-disturbance surveys for the two *Vorticifex* species, while only Alternative 3 requires pre-disturbance surveys for *Ancotrema voyanum*. The benefits of this would be most apparent for *Ancotrema voyanum* because it is least likely to be secure within Riparian Reserves. Recent collections have shown that it also occurs in upland areas. Frest and Johannes (1999a) believe that it is unlikely that additional populations of *Vorticifex klamathensis sinitsini* or *Vorticifex* n. sp. 1 will be found with further survey efforts because they have extensively surveyed the likely range of these species.

In conclusion, for the two *Vorticifex* species, while there is a moderate level of uncertainty due to the possibility that stochastic disturbance events might eliminate some populations, all alternatives would provide sufficient habitat (including known sites) to allow each species to stabilize in a pattern similar to their reference distribution.

*Ancotrema voyanum* has a limited range and current knowledge indicates that less than 50 known sites exist. Alternative 3 would best ensure stable populations across its range because it contains the requirement for equivalent-effort, pre-disturbance surveys. Under Alternatives 1 and 2, some sites could be inadvertently lost to habitat-disturbing activities while its status is determined because pre-disturbance surveys are not required. The species is not known to be abundant enough to tolerate the loss of populations and remain stable across its range. Therefore, while there is a moderate level of uncertainty due to lack of survey effort and lack of knowledge of habitat relationships, the No-Action Alternative and Alternatives 1 and 2 would provide habitat (including known sites) insufficient to support stable populations of the species. Alternative 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

***Megomphix hemphilli* (south of the south boundary of Lincoln, Benton, and Linn Counties, Oregon), and *Monadenia churchi***

**Background and Affected Environment**

*Megomphix hemphilli* and *Monadenia churchi* are two snail species that do not appear to be rare, but their present status is uncertain and additional information is needed to determine whether management under the Survey and Manage Standards and Guidelines is warranted. Both *Megomphix hemphilli* and *Monadenia churchi* are endemic species. *M. hemphilli* occurs only in western Oregon and the Puget Trough of Washington (Applegarth 1999). *M. churchi* has only been confirmed to occur in a small area in northern California and there has been a loss of populations within its historic range (Roth 1993). Pre-disturbance surveys are considered practical for both species.

The range of *Megomphix hemphilli* has been split at the south boundary of Lincoln, Benton, and Linn Counties, Oregon because of the different number of known sites north (70-100 recent federal sites) and south (250-300 recent federal sites) of this line. *M. hemphilli* was commonly found during pre-disturbance surveys in southwestern Oregon in and between the Cascade and Coast Ranges, but it is apparently rare in the northern part of its range. No currently extant sites were known for this species during the FEMAT analysis. All sites cited as “current distribution” by Frest and Johannes (1993) are now known to be erroneous (Applegarth 1999 and Frest and Johannes, public comment letter). It has only been rediscovered near its type locality, Olympia, Washington, within the last year (Burke 2000, pers. comm.). *Megomphix hemphilli* is typically associated with moist conifer and hardwood forests with big-leaf maple and sword fern as a major component (USDI 1999).

*Monadenia churchi* has been found during pre-disturbance surveys more commonly than expected, but it is confined to a relatively small area of endemism: mainly two counties in northern California with a few scattered additional sites in adjacent counties. Between 220 and 330 recent federal sites have been recorded for this species since 1994. The newly discovered sites slightly extend the range of this species. Reported collections of this species are problematic because there are similar species (although not published taxonomic entities) within or near its

range (Frest and Johannes, public comment letter). *Monadenia churchi* is typically associated with dry, exposed slopes, limestone outcrops, caves, and talus slides, or Douglas-fir logs (especially where organic litter accumulates) and oak-pine woodlands (Roth and Eng 1980, Roth and Pressley 1986, and Roth 1993).

An assumption of reference distribution was made based upon presently known species distributions and the proximity of suitable habitat according to historic records, elevation, climate, and potential natural vegetation. The following information provides some characterization of the suspected reference distribution for these species.

Although there is a moderate level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Megomphix hemphilli* (south of the south boundary of Lincoln, Benton, and Linn Counties, Oregon), it occurs in multiple sites and/or clusters with limited connectivity.

Although there is a moderate level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Monadenia churchi*, it occurs in sites and clusters with multiple avenues of connectivity.

The suspected geographic ranges and distributions within those ranges for these species are described below.

*Megomphix hemphilli*, south of the south boundary of Benton, Lincoln, and Linn Counties, Oregon has a widespread overall geographic range and its distribution within that range is widespread, but spotty.

*Monadenia churchi* has a limited overall geographic range and its distribution within that range is widespread, but spotty.

### **Environmental Consequences and Comparison of Alternatives**

Both species are assigned to Category 1F under Alternative 1, Category 2D under Alternative 2, and Category 3C under Alternative 3 (see Table 2-2). Both species are in Categories 1 and 2 of the No-Action Alternative, which require management of known sites and pre-disturbance surveys. Under Alternative 1, only strategic surveys would be conducted. Under Alternative 2 known sites as of September 30, 1999, would be managed and strategic surveys would be conducted. Under Alternative 3, all known sites would be managed and strategic surveys would be conducted.

Considering that *Megomphix hemphilli* would still be managed under Category A in each action alternative in the northern part of its range, it should remain secure in that area. However, the southern Oregon populations are the heart of the range for this species where approximately 300 sites have been reported, mainly as a result of pre-disturbance surveys. Since Alternative 1 does not provide for management of known sites for either species, there is a concern that when habitat-disturbing projects are implemented, the populations in those habitats could be reduced or eradicated, confining the remaining populations to a few scattered refugia, with little or no connectivity, in that part of the range. It is possible that some provision for stability of these species would be conferred by the existence of populations within Late-Successional and Riparian Reserves which together comprise more than 80 percent of the landscape and where habitat disturbance would be minimal. Since these species are believed to be associated with old-growth, it might be reasonable to expect that they would be equally, or even more, abundant in reserves where suitable habitat is most extensive. However, it is unclear whether enough populations would remain to compensate for the consequences of eliminating both management of known sites and pre-disturbance surveys for these two species. Strategic surveys alone would not provide stability for these two species for several reasons. There is no empirical evidence to validate the expectation that occupied sites would be frequently discovered in reserves, because reserves have not been the subject of pre-disturbance surveys. In addition, only about 10 percent of the sites where *Megomphix hemphilli* has been recorded to occur are in reserves (USDA, USDI Species

Review Panel 2000b). Finally, mollusks in reserves are vulnerable to disturbances such as wildfire and prescribed burning. This is the result of their susceptibility to desiccation (drying out) when cover is removed and a poor ability to recolonize because of a tendency for individuals to return to highly localized, sheltered sites within a radius of a few meters (Roth and Pressley 1986). Their slow rate of dispersal means that they may not effectively exploit new suitable habitats as they become available.

The strategic surveys required under all action alternatives would help to resolve questions about what management is most appropriate to provide a reasonable assurance of stability. Strategic surveys would improve knowledge related to habitat associations, range, and abundance. Strategic surveys would better accomplish this objective than the pre-disturbance surveys because more discoveries of new populations are expected when surveying in what is believed to be suitable habitat. However, there is no requirement to manage and protect sites discovered during strategic surveys. In contrast, pre-disturbance surveys under the No-Action Alternative have the advantage of managing newly discovered sites to avoid disturbance, thereby providing greater assurance that populations will not be lost when their habitats are disturbed. Strategic surveys substitute efficiency and effectiveness for the considerable investment of resources required to conduct pre-disturbance surveys.

In conclusion, while there is a moderate level of uncertainty due to lack of knowledge of current distribution, habitat requirements, and unresolved taxonomic affinities for these species, the No-Action Alternative and Alternatives 2 and 3 would provide habitat to allow both species to stabilize in a pattern different from their reference distributions. While there is a high level of uncertainty due to lack of knowledge of habitat relationships and unresolved taxonomic relationships between specimens recorded as these species, Alternative 1 would provide inadequate habitat (including known sites) to maintain the two species.

## **Mollusk Species Proposed For Removal From Survey and Manage Standards and Guidelines**

### ***Prophysaon coeruleum* in Oregon**

#### **Background and Affected Environment**

*Prophysaon coeruleum* (blue-gray tail-dropper) is a small slug, usually no greater than 3 cm in length, and is often smaller, making accurate identifications difficult. Specimens of the genus are easily recognized by a few diagnostic features: (1) the pneumostome or breathing pore is located on the right side of, and anterior to, the mid-point of the mantle; (2) there is no caudal pit; and (3) a line of abscission is present on the tail. The species can be distinguished by the presence of a blue-gray color, and unique pattern of roughly horizontal and parallel ridges and grooves on its tail, that become oblique on the sides anteriorly, towards the mantle.

Burke (1999) provided a summary of habitat and diet for *P. coeruleum*. The species appears to be primarily confined to old-growth forests in the northern portion of its range. It apparently is most abundant in western Oregon, where it may occur in moist second-growth stands having old-growth characteristics such as large down wood and high canopy cover. At a finer, microhabitat scale, it is usually found on the forest floor under bark, or among mosses or litter under conifer logs, where the ground is moist and well shaded. *P. coeruleum* is mycophagous (eats fungi) and ingests a variety of mycorrhizal fungi that are beneficially symbiotic with vascular plants. It is apparently an agent for the dispersal of fungal spores.

For purposes of discussion and analysis, site records for *Prophysaon coeruleum* have been split into two groups based on major differences in the number and density of records in different geographic areas. In Washington, only a single site was recorded prior to 1994; since then, pre-disturbance surveys have discovered three additional sites. In Oregon, at least nine locations were reported prior to 1994 (Pilsbry 1948 and Branson and Branson 1984); since then it has been



recorded over 6,000 times from 500 to 1050 sites (see Table F-2). The majority of these new sites are on federally managed lands. This species was not known to occur in California prior to 1994, and pre-disturbance surveys since then have discovered three sites. As a result, this species is still considered to be rare in Washington and California. It is considered abundant in Oregon wherever suitable habitat occurs.

Prior to 1994, the presumed range of *P. coeruleum* was from the Puget Trough in Washington to the Coast and west Cascade Ranges of Oregon and as far east as Upper Klamath Lake (Pilsbry 1948, Branson and Branson 1984, Frest and Johannes 1996c, and Burke 1999). In western Oregon, *P. coeruleum* was rarely recorded in the decade prior to FEMAT (e.g. Branson and Branson (1984) collected a single specimen from each of six different sites). Pre-disturbance surveys since then have located over 1,000 new sites (see Table F-2). Assuming that all of these records are valid, it would be reasonable to conclude that the species is abundant and widespread throughout a variety of moist, forested habitats. However, accurate identifications may be complicated because *P. coeruleum* is not the only small blue-gray colored slug within this geographic area (Burke 2000, pers. comm. and Duncan 2000, pers. comm.). DNA analysis has recently confirmed that there are at least six genetically distinct types in Oregon. These six types, that superficially resemble *P. coeruleum*, all partially occur in the Klamath Physiographic Province of southwestern Oregon and all may be separate, undescribed species (Wilke and Davis 2000). Furthermore, specimens tentatively recorded as *P. coeruleum* from the vicinity of Mt. Shasta are so genetically distinct that they appear to be a separate genus (Wilke and Davis 2000). This predicament complicates interpretation of the data on range and habitats. Voucher specimens are not available and reexamination of collected specimens to determine the true identity is not possible since voucher specimens have not always been retained. It is also not possible to definitively decipher whether the data were collected for true *P. coeruleum* or another similar-appearing species or subspecies. Wilke and Davis (2000) concluded that additional work would be required to resolve the taxonomic affinities of specimens recorded as *P. coeruleum* by studying a much higher number of populations and by combining molecular, anatomical, ecological, and biogeographical data.

Other blue-colored slugs that occur or potentially occur within the range reported in the literature for *P. coeruleum* (Pilsbry 1948 and Frest and Johannes 1993) can be distinguished from *P. coeruleum* on the basis of external characters and/or DNA analysis. Some of these varieties have been confused with *P. coeruleum* during surveys because they are similar in appearance (Burke 2000, pers. comm. and Duncan 2000, pers. comm.). These varieties include:

1. The Klamath tail-dropper. This slug occurs on the east slope of the Cascade Range in southern Oregon and crosses over to the west side on south-facing, dryer exposures. It may also occur in the Siskiyou National Forest, west of Ashland (Duncan 2000, pers. comm.). Although not enough collections have been made to ascertain its habitat, it is often found in much dryer sites than typical *P. coeruleum*. The potential area of geographic co-occurrence between *P. coeruleum* and the Klamath tail-dropper is located in the upper Rogue and Umpqua River drainages of eastern Jackson and Douglas Counties, although these species have not yet been found to occur at the same site in the same habitat (Frest and Johannes 1999b). This species can be recognized by the presence of a brownish tint on the body and an even darker colored sole. Although not yet described in scientific literature, the Klamath tail-dropper has been tentatively determined to be a species distinct from *P. coeruleum* based on external characters and dissection (Frest 1999b). DNA analysis of specimens from the Winema National Forest has shown that there may actually be three separate taxa within this sub-group (designated as Taxa A, B, and C by Wilke and Davis (2000)). Although this slug has been found many times, it has not consistently been distinguished from typical *P. coeruleum* when entered into the database.
2. The blue-white tail-dropper. This species-type has been found in the Coast Range of Oregon (Burke 2000, pers. comm.). The body has a lighter color than *P. coeruleum*, and a pattern of flat, elongated polygons rather than the unique pattern of ridges and

grooves on the tail that is characteristic of *P. coeruleum*. The habitat has not been described for this slug. The potential area of geographic co-occurrence between *P. coeruleum* and the blue-white tail-dropper is located in the central Coast Range of western Oregon. This species has not been subjected to DNA analysis.

3. The Ryan Lake Slug (so called for the location at which it was first discovered) is a small bluish-white, undescribed slug found within the northern part of the range of *P. coeruleum* and is known to have been reported as *P. coeruleum* during pre-disturbance surveys even though it is obviously a different genus (Burke 2000, pers. comm.). This slug may potentially co-occur with *P. coeruleum* at mid-elevations, from the Olympic National Forest to the approximate latitude of Salem, Oregon, in both the Cascade and Coast Ranges. It has been found fairly commonly, in forest stands, often associated with conifer logs. This slug is of about the same length as *P. coeruleum* but is slimmer. Among other distinct characteristics, it is easily distinguished from *P. coeruleum* because its pneumostome is located well toward the posterior end of the mantle and its tail is keeled for its full length behind the mantle. Neither of these traits is characteristic of *P. coeruleum*. The color is light blue to nearly white and small specks of white, black, or pink pigments are visible in the integument under magnification. DNA analysis has shown that this taxon is more closely related to members of the genus *Hemphillia* than to the genus *Prophysaon* (Wilke and Davis 2000).
4. Other taxa have been identified in Southern Oregon using DNA analysis that are genetically distinct from northern Oregon specimens. (Designated as Taxa D and F by Wilke and Davis (2000).) No external characteristics are currently known which would allow surveyors to consistently distinguish these varieties of tail-droppers from typical *P. coeruleum*.

Although there is a low level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Prophysaon coeruleum* in Oregon, it occurs in multiple sites and clusters with multiple avenues of connectivity.

The overall geographic range for *Prophysaon coeruleum* in Oregon, when interpreted as a single, highly variable species, is widespread and its distribution within that range is widespread and even. The overall geographic range for *Prophysaon coeruleum* in Oregon, when interpreted as a species complex, is unknown and its distribution within this range is also unknown.

### **Environmental Consequences and Comparison of Alternatives**

Under all of the action alternatives, *P. coeruleum* would be removed from the Survey and Manage Standards and Guidelines within Oregon. In the No-Action Alternative, *P. coeruleum* is managed under Categories 1 and 2, which require management of known sites and pre-disturbance surveys. Since substantial complications exist when attempting to unequivocally interpret site records for this species, the following analysis describes the environmental consequences of removing *P. coeruleum* from the Survey and Manage Standards and Guidelines in Oregon under two scenarios. Based on the assumption that all known site records are valid, the first scenario considers the environmental consequences of managing it as a single species. The second scenario considers the environmental consequences of managing it as though it were a complex of several species. This analysis accepts the evidence that: (1) several distinct species exist in Oregon; (2) not all of the site records for this species are valid; and (3) the distribution and abundance of this species are not accurately reflected in the site records.

#### **Management as a Single Species**

The standard practice for Survey and Manage species is to establish known sites based on the presence of the species as identified by trained surveyors following a standard field survey protocol (USDA, USDI 1998d and USDA, USDI 1998b, respectively). Consistent with this

practice, specimens resembling *P. coeruleum* are considered to be a single species since no other species that closely resembles it, and could be confused with it, have been described in the scientific literature. Under this concept, the species occupies a relatively large range in Oregon and has been documented at 500 - 1,050 sites, based on over 6,000 records. It is capable of utilizing a broad variety of habitat conditions and is common. The basis for this conclusion is that this species has a high number of extant sites, which are widespread, with a fairly even geographical distribution within its range, and that the proportion of potential suitable habitat within the reserves is high. The habitat amplitude for the species is considered to be broad, based on habitat data from all records. Thus, there is a proportionally high amount of this suitable habitat within reserves. There is a low proportion of sites currently documented in reserves (most records resulting from pre-disturbance surveys are located within the Matrix land allocation), but the assumption is that large numbers of undiscovered sites are located where suitable habitat exists within the reserve system. Based on the presumption of a broad habitat association, the reserve system, and the high number of populations expected to reside within it, available suitable habitat is considered sufficient to maintain stability for this species.

In conclusion, if *P. coeruleum* is simply a highly variable species, while there is a moderate level of uncertainty due to lack of knowledge regarding trend in current distribution and unresolved taxonomic identities of specimens recorded as this species, all alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern different from its reference distribution.

#### Management as a Complex of Several Species

If the recently documented sites actually represent records for a complex of several species, there would be a concern for stability of this species because there is a lack of certainty about which sites are actually occupied by *P. coeruleum*. The true abundance and distribution of this species would be obscured. The perception that this species has broad habitat associations would also be invalidated. These circumstances preclude reaching a definitive conclusion about whether the species would be able to achieve stable populations throughout its range. If *P. coeruleum* is actually a rare species with a restricted distribution, there would be a risk that the true nature of its abundance and distribution would be unrecognized and that disturbance of its habitat would pose a serious threat to its stability and pattern of distribution because populations could suffer fragmentation and loss of connectivity. It is also possible that some populations might be lost. The No-Action Alternative would be the best management option for this species, because populations would continue to receive protection under the Survey and Manage Standards and Guidelines. If the records for this species represent a complex of several species, habitat association models would not accurately reflect this species' true habitat associations. The suitable habitat for this species may be much narrower than it would otherwise appear if all records are accepted as valid.

In conclusion, while there is a moderate level of uncertainty due to unresolved taxonomic relationships between specimens recognized as this species, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern different from its reference distribution. Under the action alternatives, there is insufficient information regarding this species to determine how any alternative would affect distribution and stability.

#### *Prophysaon dubium*

##### Background and Affected Environment

*Prophysaon dubium* (papillose tail-dropper) is a small slug that grows to a length of 2 cm. The genus can be easily recognized by typical characteristics of *Prophysaon*: the pneumostome is on the right side of the mantle just in front of the middle, there is no caudal pit, and a line of abscission is present on the tail. The species is easily recognized by the distinct conical papillae covering the entire back and sides behind the neck, including the mantle, and a distinct pattern of

fine, dark-colored, impressed lines on the tail. Although, it is distinct in appearance, juveniles of other slugs may sometimes be mistaken for this species by inexperienced surveyors.

*P. dubium* has been found to be more abundant than previously thought. There have been between 300 and 500 recent federal sites recorded for this species, primarily through pre-disturbance surveys. While it is most abundant in western Oregon, its range extends onto both sides of the Cascade Range in northern Oregon and north into Chelan County, Washington on the east slope of the Cascade Range. In the south, its range extends farther into northwestern California than was previously known. This species has a broad ecological amplitude.

*P. dubium* occurs among hardwoods within late-successional forests and in riparian habitat. It is not a riparian obligate in the conifer forests on the west side of the Cascade Range, but appears to be confined primarily, although not exclusively, to riparian areas in the drier forest types on the eastern slope of the Cascade Range. It can be found among deciduous leaf litter and on logs or small woody debris (most often hardwoods).

Although there is a low level of uncertainty because of limited information and lack of knowledge about suitable habitat and dispersal capabilities of *Prophysaon dubium*, it occurs in sites and/or clusters with limited connectivity. The overall geographic range for *Prophysaon dubium* is widespread and its distribution within that range is widespread, but spotty.

### **Environmental Consequences and Comparison of Alternatives**

*Prophysaon dubium* would be removed from the Survey and Manage mitigation measure under all action alternatives. Given the high number of known sites, and its habitat and distribution, there would be a low concern for its stability and pattern of distribution. In western Oregon, where it is most abundant, it may be somewhat vulnerable to intensive timber harvest and prescribed burning. In eastern Washington, where it is less common, it would be protected, to some degree, by Riparian Reserves. Since it seems to be largely associated with hardwoods, which also increase with conifer removal, this species would probably remain stable across its range protected in riparian areas and by other Northwest Forest Plan Standards and Guidelines. By remaining stable across its range, it would likely be able to recolonize managed areas from Riparian Reserves, Late-Successional Reserves, and other refugia. While there is a moderate level of uncertainty due to unresolved taxonomic affinities between specimens recognized as this species and its habitat associations, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution, and the action alternatives would provide sufficient habitat (including known sites) to allow this species to stabilize in a pattern different from its reference distribution.

## **Amphibians**

### **General Discussion**

Approximately 32 species of amphibians are found in the Pacific Northwest, not all are found in coniferous forest habitat. Twenty of the 32 species are endemic to, or have a majority of their ranges within, the Northwest Forest Plan area. The Pacific Northwest supports a high number of the amphibian species known in the United States, second only to the southeast.

Amphibians are functionally important components of coniferous forests in the Pacific Northwest. Amphibians can reach high densities in forest ecosystems and the complex life histories of many taxa bridge aquatic and terrestrial habitats. Larvae, juveniles, and adults may function as predators or as a major food source for other vertebrate species and invertebrates.

Amphibians are particularly sensitive to environmental change because their complex life cycle exposes them to hazards in both aquatic and terrestrial environments. Most western forest species

require cool, moist conditions to maintain respiratory function. Stream-dwelling species generally require cool water and are sensitive to sedimentation that can inhibit reproduction, reduce availability of protective cover, and affect foraging. In the Pacific Northwest, local populations of several amphibian species have been extirpated or have been reduced in abundance and distribution. The ranges of several species have been drastically reduced. Many such declines have occurred in forest-dwelling species.

For a species to have been considered in the development of the Northwest Forest Plan, it must have met criteria for being closely associated with late-successional or old-growth forest conditions. Of endemic Pacific Northwest amphibians, 19 species met these criteria (Thomas et al. 1993 and USDA, USDI 1993). One species, the California slender salamander, was eliminated from the FEMAT viability panel assessments for the development of the Northwest Forest Plan because it occurred on few federally managed lands within the range of the northern spotted owl (USDA, USDI 1993). Thus, 18 species (17 salamanders and 1 frog) were evaluated during Northwest Forest Plan development.

For 12 of these 18 species, several provisions and mitigation measures of the Northwest Forest Plan were expected to contribute to a relatively high likelihood of stable, well-distributed populations on federally managed land within the range of the northern spotted owl (USDA, USDI 1993 and USDA, USDI 1994a).

However, a relatively high likelihood of stable, well-distributed populations was not anticipated to result from this habitat-based approach for six species. Of these six species, the Columbia torrent salamander was eliminated from further consideration because its range was coincident with few federally managed lands (northwestern Oregon and southwestern Washington) and federal land management would not maintain stable, well-distributed populations. Because torrent salamander is a stream-dependent species, Riparian Reserves would benefit it where it occurs locally on federally managed lands, especially in headwater areas.

The five remaining species were included in the Survey and Manage Standards and Guidelines for the development of species-specific mitigation measures: Del Norte, Larch Mountain, Shasta, Siskiyou Mountains, and Van Dyke's salamanders in the Cascade Range (USDA, USDI 1993). These five species have ecological similarities; they are lungless salamanders found in terrestrial environment without an aquatic life history stage. They nest in terrestrial refugia and develop directly from eggs to miniature salamanders without a free-living larval stage. Four of these five species (all but the Van Dyke's salamander) also were included under Protection Buffer Standards and Guidelines (USDA, USDI 1993). Survey and Manage and Protection Buffer mitigation measures were considered to increase the likelihood of these species to attain stable, well-distributed populations on federally managed lands within the Northwest Forest Plan area.

An important distinction must be made between "sites" and "populations" for the species discussed in this section. Populations of interacting individuals may be comprised of numerous sites, as used in this and accompanying documents. A site is a distinct geographic location (e.g., at which a particular survey occurred), but is not a demographic delineation.

Numbers of known sites vary between documents referencing Survey and Manage salamander species, such as Survey Protocols, Species Review Panels, and within this SEIS between this section and Appendix F. Contributing to these inconsistencies are the use of different: (1) databases (ISMS, Nauman unique sites database, and USDA, USDI 1999b) with updates occurring at different times; (2) quality assurance measures that only distinct sites (and not duplicate records) are tabulated; (3) criteria for known site definitions; and, (4) filters used to screen databases for various data tabulations. In these salamander effects analyses, the Nauman unique sites database (USDA, USDI 1999b and USDA, USDI Species Review Panel 2000b) generally was used because there has been more data quality assurance to determine numbers of distinct known sites. The differences in data quality and numbers of records are not of a magnitude to alter conclusions regarding effects of management alternatives on species or species category assignment in this SEIS.

## **Summary of Effects**

A brief summary of effects for salamanders is provided here, prior to the detailed discussion, because of the length of this section.

Five salamanders, Del Norte, Larch Mountain, Shasta, Siskiyou Mountains, and Van Dyke's, are included in the Survey and Manage Standards and Guidelines under all alternatives. There are no salamanders that would be removed from the Survey and Manage Standards and Guidelines under any alternative.

The four alternatives have similar management actions: manage known sites, pre-disturbance surveys, and strategic surveys or extensive and regional surveys. The provision for conducting strategic surveys under the action alternatives would increase the efficiency and effectiveness of species management in the future, by prioritizing and targeting surveys to address specific questions relative to management necessary for a species. Extensive or general regional surveys are not required for these species under the No-Action Alternative.

The three action alternatives have similar provisions for adaptive management to allow the Agencies to respond to changing information and to provide appropriate management for the species. Adaptive management will result in more effective species management by assigning the species to the category that provides the appropriate level of management.

Compared to the No-Action Alternative, species receive different management under the action alternatives as a result of the application of new information and the slightly different emphasis of the alternatives. Under Alternatives 1, 2, and 3, strategic surveys are added for all five salamander species.

Alternatives 1, 2, and 3 would remove pre-disturbance surveys for the Del Norte salamander. Alternative 2 would also remove pre-disturbance surveys for the Siskiyou Mountains salamander.

The No-Action Alternative generally provides less protection than the action alternatives for Shasta, Van Dyke's, Larch Mountain, and Siskiyou Mountains salamanders (except for Alternative 2) and roughly equal protection to Del Norte salamanders (except for Alternative 2). Nevertheless, overall for Van Dyke's, Larch Mountain, and Siskiyou Mountains salamanders, the No-Action Alternative provides sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to their reference distributions. For Shasta and Del Norte salamanders, the No-Action Alternative would provide habitat (including known sites) sufficient to allow species to stabilize in a pattern different from their reference distributions, based on existing management using Protection Buffer management guidelines.

Under Alternative 1 and 3, all five salamanders are projected to have sufficient habitat (including known sites) to stabilize in a pattern similar to their reference distributions with varying levels of uncertainty.

Under Alternative 2, the Shasta, Larch Mountain, and Van Dyke's salamanders are expected to have sufficient habitat (including known sites) to stabilize in a pattern similar to their reference distributions with a low level of uncertainty. For both the Siskiyou Mountains and Del Norte salamanders, while there is a high level of uncertainty (moderate for Siskiyou Mountains salamander in California) due to an inability to project future management trajectories, this alternative would provide habitat (including known sites) sufficient to allow species to stabilize in a pattern different from their reference distributions.

## Shasta Salamander (*Hydromantes shastae*)

### Background and Affected Environment

In the Northwest, this species is the least known salamander with an extremely limited range (USDA, USDI 1994b, Appendix J2). It occurs only in California near Shasta Lake. This species had a slightly broader range historically; inundation of the species' habitat by the creation of Shasta Lake likely fragmented and reduced habitat, diminishing and isolating populations.

Within its range, there are limited locations scattered throughout the Northwest Forest Plan area. Two levels of patchiness apply to the distribution of this species their suitable habitat is patchy in distribution and the species distribution is patchy within apparently suitable habitat. Concern for the maintenance of its few, scattered populations stems from its low dispersal ability, low reproductive rate, and narrow habitat and microclimate requirements that are sensitive to disturbance (USDA, USDI 2000). These concerns are explained further below.

The biological distribution of this species is not well known, but currently is likely a mix of isolated sites, site clusters, and sites/clusters with limited connectivity. Historically, the species likely had greater connectivity among subpopulations through habitat now inundated by the filling of Shasta Lake; however, some limitations are likely. This is supported by genetic data showing potentially species-level differentiation among distinct populations. There is a concern about some populations of this species in light of genetic information (Wake et al. 1978; Pappenfus and Brouha 1979; and USDA, USDI 2000). Genetic differences among some adjacent populations of the Shasta salamander are as great as between this species and a closely-related species in the Sierra Nevada Range. This is relevant because loss of single populations may represent a substantial loss of biodiversity. Dispersal ability and connectivity among sites or populations of this species is not well known.

There have been 51 sites discovered that likely represent about 14 populations. Most sites were reported over two decades ago; it is not known how many sites are still extant. After 1993, the Northwest Forest Plan led to survey efforts for salamander species named in the Survey and Manage mitigation measure (USDA, USDI Species Review Panel 2000b). However, few projects have been proposed that would trigger pre-disturbance surveys for this species and only 5 of the 51 sites have been found since 1993 (USDA, USDI Species Review Panel 1999b). There is no information currently available to address the size of individual populations in terms of species relative abundances.

The reference distribution for this analysis is represented by the current distribution. This distribution incorporates the existing extent of Shasta Lake, which, upon its creation, reduced the historical distribution of potential habitat for Shasta salamanders. Due to limited sampling, there is considerable potential habitat that remains an unknown. It is likely that future inventories will better define and possibly expand the known species range and habitat.

Habitat is thought to be primarily limestone rock outcrops as originally described in the Northwest Forest Plan (USDA, USDI 1994b, Appendix J2). Recent surveys indicate that this animal also inhabits the forested slopes adjacent to rock outcrops, at least up to 200 meters from the edge of an outcrop (Lewendal 1995; Lewendal 1999 and 2000, pers. comm.; and USDA, USDI 2000). The species may have a broader distribution than historically recognized, including forested sites distant from rock outcrops. Similar to other salamanders, habitat may include a mix of surface refugia providing suitable micro-habitat and microclimate conditions. Surveys for this species have focused on limestone rock outcrops (Pappenfuss and Brouha 1979 and Lewendal 1995). Potential habitat has not been well surveyed (Lewendal pers. comm.).

Cool, moist microclimate conditions are important for this species survival (USDA, USDI 2000). During seasons of surface activity, down wood appears to be used as dominant micro-habitat cover in forested slopes adjacent to outcrops and in those few sites not associated with rock (Lewendal

1995 and USDA, USDI 2000). Down wood and rocky substrate apparently provide cool, moist retreats needed for the survival of this species. Changes in habitat that alter microclimates (such as increasing temperatures or decreasing moisture levels) or micro-habitat structure (reduced wood or compacted substrates) are expected to have adverse effects on the survival of this species. Such changes occur with a variety of timber harvest and other land management activities.

The species was identified as being associated with late-successional or old-growth forest habitat (USDA, USDI 1993); however, some documentation does not specify such an association (USDA, USDI 1994a). There are attributes of late-successional or old-growth forests (such as down wood and cool moist microclimates) that are important for this species survival and recently described non-rock sites are located in late-successional forest (USDA, USDI Species Review Panel 2000b and 2000c). These attributes occasionally appear in younger age class forest habitat. At some localities, the species appears to occur without canopy closure because those sites have deep rocky substrates (USDA, USDI 2000). At such sites, the layers of loose, rock material (soil and substrate) may be a surrogate for the canopy relative to microclimate buffering (deMaynadier and Hunter 1995).

Federally managed lands figure prominently as habitat for this animal (USDA, USDI 1994b). In 1999, about 70 percent of both known sites and the known range were on federally managed lands. About 25 percent of the range is in reserve land allocations (USDA, USDI Species Review Panel 2000b).

### **Environmental Consequences and Comparison of Alternatives**

All three action alternatives effectively provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution on federally managed lands within the Northwest Forest Plan area. Under all alternatives, all current and future known sites would be managed and pre-disturbance surveys would be required. These mitigation measures reduce the chance of inadvertent loss of sites from management activities.

Also, under all alternatives, Riparian Reserves provide incidental protection for Shasta salamander populations in or near aquatic habitats because it is not a riparian-dependant species. Activities within Riparian Reserves (such as unmanaged recreation activities) could adversely affect salamanders by direct habitat disturbance or by indirectly altering microclimate regimes.

This species is in Category 1A, 2A, and 3A under the action alternatives. Strategic surveys are required. Critical knowledge gaps would be filled with this measure, resulting in accelerated adaptive management which is an advantage to both species conservation and management implementation. New information compiled from strategic surveys would be essential for refining and updating Survey Protocols and Management Recommendations. Strategic surveys could benefit species management by investigating potential source populations, habitat requirements, geographic range, location of extant sites, management effects, population demographics at known sites, and distribution of this species on reserve land allocations. The No-Action Alternative has no provision for strategic surveys for Shasta salamander. Adaptive management for Shasta salamander is accelerated under all action alternatives in comparison to the No-Action Alternative; information gaps would be filled quicker and conservation strategy development would be on a faster track.

Under the No-Action Alternative, the Shasta salamander is a Protection Buffer species and is managed under Categories 1 and 2 of the Survey and Manage Standards and Guidelines. There is conflicting guidance between the two because management specified for both proposed activities and areas differ. This conflicting guidance could result in adverse effects on the maintenance of salamanders at known sites. Although Management Recommendations might override Protection Buffer guidance, there is a chance that confusion could lead to continued use of Protection Buffer Standards and Guidelines (see below).



The Protection Buffer Standards and Guidelines under the No-Action Alternative do not sufficiently recognize the area surrounding limestone rock outcrops as habitat for this species. Outcrops are buffered to the distance of the height of one site potential tree or 100 feet (30 meters), whichever is larger. This species occurs at least up to 650 feet (200 meters) from outcrops (Lewendal 1995 and USDA, USDI 2000). Thus, no “buffer” is offered to the site and not all occupied areas would be within the perimeter of the managed site. If a buffer were needed to maintain occupied site micro-habitat or microclimate for Shasta salamander, reduced salamander survival or reproduction might be incurred by the Protection Buffer guidance. Results of such a scenario might range from effects on population demography from reduced surface activity (foraging and reproduction) to greater chance of site-level extirpation. Utilization of the Protection Buffer guidance under the No-Action Alternative would lead to adverse impacts to individuals and potentially populations reliant on slope habitat adjacent to outcrops. This might alter the distribution of the species from the current distribution. Uncertainty in this determination comes from our lack of knowledge of the importance of slope habitat around outcrops, or other non-rock habitat, for the maintenance of populations.

Since Protection Buffer guidance under the No-Action Alternative provides for a uniformly applied buffer, there is no allowance for determining a site-specific buffer. Less or no buffer might be warranted if an action was determined to have a negligible effect. The cost of imposing unnecessary buffers is high under the No-Action Alternative. Conversely, if a larger buffer were needed to maintain micro-habitat (e.g., downed wood recruitment, slope stability, and hydrology) and microclimate (e.g., edge effects (Chen et al. 1995)), an effect on salamanders could be incurred ranging from altered population demography to greater probability of site-level extirpation. Additionally, Shasta salamander sites not associated with limestone outcrops are not included in the Protection Buffer mitigation measure putting populations at high likelihood of extirpation.

Finally, whereas the Protection Buffer guidance protects outcrop sites from timber harvest, mining, quarry activity, and road building, recreation also is identified as a dominant threat (USDA, USDI 2000). In the region of Shasta Lake, recreation use of federally managed lands is escalating. Collection of downed wood for firewood can have effects on the availability of surface refugia for salamanders, affecting salamander survival and potentially population stability. This may alter the projected distribution of this species at affected sites. Uncertainty relative to recreation impacts stem from our lack of knowledge regarding the specific effects of this type of disturbance on these salamanders.

The No-Action Alternative (with either the Protection Buffer standards or implementation of the draft Management Recommendations) contributes to the maintenance of populations of this species on federally managed lands through management of all current and future known sites, but may not contribute to maintenance of gene flow among the scattered populations of this species due to a lack of provisions addressing connectivity of clustered sites. This loss of gene flow among isolated populations can lead to altered genetic diversity and can increase the probability of extirpation events. Loss of any site would be a concern for this species because so few sites are known. This issue may be of less concern for this species due to its occurrence in a national recreation area. In contrast, all three action alternatives include strategic surveys which may gather the information necessary to consider potentially important connectivity areas as “additional or in-lieu direction, subject to appropriate NEPA analysis.” However, this potential for managing connectivity in the action alternatives is speculative until additional information is gathered.

Management of known sites under Alternative 3 would be similar to the other alternatives for Shasta salamander. Although Alternative 3 states that all occupied sites would be managed with a 250-meter buffer (which equates to 48.5 acres or 19.6 hectares), draft Management Recommendations allow management within this buffer if a proposed activity does not adversely affect the salamander or its habitat.

All three action alternatives provide a greater assurance of providing sufficient habitat and stable populations than the No-Action Alternative. The action alternatives are equal in their protection of this species. The Protection Buffer Standard and Guideline under the No-Action Alternative has substantial effects on Shasta salamanders because it does not recognize all suitable habitats or all management hazards to the species. Also, the No-Action Alternative does not have a mechanism for filling critical knowledge gaps to assist with species management, nor a means to address potentially important connectivity corridors because of the lack of general regional surveys. Thus, this species is most vulnerable to losses under the No-Action Alternative.

In conclusion, while there is a moderate level of uncertainty due to unknown effects on the species resulting from lack of management for connectivity among sites, the No-Action Alternative using the draft Management Recommendations likely would provide habitat (including known sites) sufficient to allow Shasta salamanders to stabilize in a pattern similar to the reference distribution. While there is a moderate level of uncertainty due to the joint effects on the species of the limited habitat definition in the Northwest Forest Plan ROD (1994) and the lack of management for connectivity among sites, the No-Action Alternative using the Protection Buffer guidance would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from the reference distribution. Alternatives 1, 2, and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. Uncertainty for all of these determinations stems from our restricted knowledge of this species' population ecology and due to unknown effects of potential future catastrophic disturbances or stochastic processes. Catastrophic disturbances and stochastic events could have a disproportionately more severe effect on this species due to its small known range and relatively few known sites.

## **Van Dyke's Salamander (*Plethodon vandykei*)**

### **Background and Affected Environment**

This species occurs in three areas of Washington, but only populations in the Cascade Range are included under the Survey and Manage Standards and Guidelines. Populations on federally managed lands in the Olympic Peninsula occur primarily (75 percent) on reserve land allocations and further mitigation was not addressed for that physiographic province (USDA, USDI 1994a). In southwestern Washington (Coast populations), this species occurs exclusively on nonfederal lands; federal land management would not affect its population stability or distribution in that area. In the Cascade Range, the species range is very limited. Only eight sites were known in 1994 and half of the range in the Cascades was thought to be on federally managed lands (USDA, USDI 1994a). Inclusion in the Survey and Manage Standards and Guidelines for the Cascade range populations was considered necessary to substantially increase its likelihood of survival.

The known sites within the Cascade Range are extremely patchy in distribution (i.e., limited locations scattered throughout the suspected range). Currently, there are 31 known sites (USDA, USDI Species Review Panel 1999b and 2000b). In 1994, the Northwest Forest Plan Final SEIS reported 8 known sites, and Wilson et al. (1995) later documented 23 sites in the Cascade Range. It is not known how many populations of this species occur in the Cascade Range. Isolation of currently known sites may reflect distinct populations or limited survey efforts (USDA, USDI Species Review Panel 2000b).

Although the biological distribution of this species is not known, it is likely that this species occurs predominantly as isolated sites, site clusters, or sites/clusters with limited connectivity. Historically, sites and site clusters presumably had at least limited connectivity, if not multiple avenues of connectivity; the limited genetic diversity between Mount Saint Helens and Mount Rainier populations suggests gene flow (dispersal) occurred between these areas. Human-caused and natural (landslides, debris flows, volcanic eruptions, fire) disturbances and environmental changes are likely to have resulted in the current pattern of disjunct sites in the Cascades. Relative abundances at extant populations are not well known.

In addition to this species rarity, concern for the maintenance of the few, scattered populations in the Cascade Range stems from its potential low dispersal ability, low reproductive rate, and narrow habitat and microclimate requirements that are sensitive to disturbance (USDA, USDI 2000 and USDA, USDI Species Review Panel 2000b). Also, there is concern for the maintenance of diversity, especially potentially unique populations based on genotypes or morphology (Brodie 1970 and Highton and Larson 1979). Loss of biodiversity (such as evolutionary significant units or distinct population segments) could result if unique sites are not maintained.

The reference distribution in the Cascade Range used in this analysis primarily reflects its current level of patchiness. It also includes a recognition of likely additional undetected sites and the historical context of likely limited connectivity among sites or site clusters across suitable habitat (extant or in restoration).

Habitat types include: headwater streams, seeps along larger streams, riparian zones of montane lakes, waterfall splash zones, fractures and cliffs with water flowing over them, forested habitats, all soils/substrates and seral stages, open rock faces, and basalt tube entrances and sky lights (USDA, USDI 2000). At such sites, the layers of loose, rock material (soil and substrate) may be a surrogate for the canopy or riparian conditions relative to microclimate buffering (deMaynadier and Hunter 1995). Sites are known up to 5,200 feet elevation. Although the definition of habitat is broad when including caves, talus, streams, and lakes, this species appears to have a strong association with riparian environments. In and near aquatic habitats, the important habitat attributes appear to be cool temperatures (4 to 14°C) (USDA, USDI Species Review Panel 2000b) and moist habitats with geologically stable substrates. Such microclimates can be found in interior forest stands and may be affected by a variety of timber harvest and other land management activities (Chen et al. 1995 and Brosofske et al. 1997).

There may be attributes of late-successional or old-growth forests (such as cool, clear water and cool, moist microclimates) to which this species has associations; however, this has not yet been clearly established for the WA Western Cascades Physiographic Province (USDA, USDI Species Review Panel 2000b). Preliminary results from the Olympic Peninsula population have found the species to have a higher frequency of occurrence and greater abundances in stands with late-successional characteristics (Jones et al. unpubl. and USDA, USDI Species Review Panel 2000b).

Federally managed lands figure prominently as potential habitat for Van Dyke's salamander (USDA, USDI 1994a). Currently, 23 of 31 known sites, and about half of the known range, are on federally managed lands (USDA, USDI Species Review Panel 2000b). About half the known sites are within reserve land allocations.

Several potential and known threats to this salamander are identified due to adverse effects on habitats and microclimates. These include road building and timber harvest. In particular, channel scouring resulting from mass-wasting events, such as landslides, can be detrimental to this species (Crisafulli pers. comm. and USDA, USDI Species Review Panel 2000b).

### **Environmental Consequences and Comparison of Alternatives**

All three action alternatives provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution on federally managed lands within the Northwest Forest Plan area in the Cascade Range. Under the No-Action Alternative, Van Dyke's salamander is Category 2. Under the action alternatives, it is Category 1A, 2A, and 3A. These action alternative categories require pre-disturbance surveys, known site management, and strategic surveys. The No-Action Alternative requires known site management and pre-disturbance surveys. These mitigation measures reduce the chance of inadvertent loss of undiscovered sites from management activities.

Under all alternatives, Riparian Reserves contribute to the protection of Van Dyke's salamander populations in or near aquatic habitats, but may not provide sufficient protection for this species. Interim Riparian Reserve buffers are not designed to maintain "interior" conditions along streams,

which may be a concern for these salamanders. Headwater areas or isolated seeps also may be important habitats for this animal. Management within Riparian Reserves (such as activities to achieve restoration of late-successional or old-growth forest objectives and recreation) could adversely affect salamanders within these areas by direct habitat disturbance or indirectly by altering microclimate regimes. Riparian association of this species in the Cascades Range warrants further investigation. Due to the few Cascade Range sites, impacts at any site may result in vulnerability to losses or extirpation at the site.

All action alternatives include strategic surveys. Critical knowledge gaps would be filled with this measure, resulting in accelerated adaptive management which is an advantage to both species conservation and management implementation. New information compiled from strategic surveys would be essential for refining and updating Survey Protocols and Management Recommendations. Strategic surveys could benefit species management by investigating potential source populations, habitat requirements, geographic range, location of extant sites, management effects, population demographics at known sites, and distribution of this species on reserve land allocations. The No-Action Alternative has no provision for strategic surveys for Van Dyke's salamanders.

Adaptive management for Van Dyke's salamander is accelerated under all action alternatives in comparison to the No-Action Alternative: information gaps would be filled quicker and conservation strategy development would be on a faster track. This is a benefit of the action alternatives over the No-Action Alternative because it does not provide a mechanism for attaining information for refinement of management.

Management of known sites under Alternative 3 would be similar to the other alternatives for Van Dyke's salamander. Although Alternative 3 states that all occupied sites would be managed with a 250-meter buffer (which equates to 48.5 acres or 19.6 hectares), draft Management Recommendations allow management within this buffer if a proposed activity does not adversely affect the salamander or its habitat.

The No-Action Alternative contributes to the maintenance of populations of this species on federally managed lands through management of all current and future known sites, but may not contribute to maintenance of gene flow among the scattered populations by addressing connectivity of clustered sites. This loss of gene flow among isolated populations can lead to altered genetic diversity and can increase the probability of extirpation events. This increases uncertainty for projections of future distribution patterns under the No-Action Alternative. In contrast, all three action alternatives include strategic surveys which may gather the information necessary to consider potentially important connectivity areas as "additional or in-lieu direction, subject to appropriate NEPA analysis." However, this potential for managing connectivity in the action alternatives is speculative until additional information is gathered.

In conclusion, Alternatives 1, 2, and 3 are equal in their protection of Van Dyke's salamander and would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. The No-Action Alternative does not have a mechanism for filling critical knowledge gaps to assist with species management, nor a means to address potentially important connectivity corridors because of the lack of general regional surveys. Thus, uncertainty and likelihood of losses to individuals and populations are greatest under the No-Action Alternative. Nevertheless, while there is a moderate level of uncertainty due to unknown effects, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. Uncertainty for all of these determinations also stems from restricted knowledge of this species' population ecology and due to unknown effects of potential future catastrophic disturbances or stochastic processes. Catastrophic disturbances and stochastic events could have a disproportionately more severe effect on this species due to its small known range and relatively few known sites.

## Larch Mountain Salamander (*Plethodon larselli*)

### Background and Affected Environment

The range of the Larch Mountain salamander is not well delineated and is limited. Originally thought to be restricted to the Columbia River Gorge, numerous sites are now known away from the Gorge. From relatively recent surveys, the range has been extended approximately 42 miles (67 kilometers) to the north and it has been found south of Mount Hood. Total area encompassed by known sites has increased from 411,846 acres (166,672 hectares) in 1980 to 2,901,240 acres (1,174,116 hectares) in 2000 (USDA, USDI Species Review Panel 2000b).

Overall, occupied sites are found in limited locations scattered throughout the range, but there is clustering of sites along the Columbia River Gorge, on each side of the Columbia River. Currently, there are 111 known sites of the Larch Mountain salamander, 28 in Oregon and 83 in Washington (USDA, USDI Species Review Panel 2000b). About one-third of these have been identified since implementation of the Northwest Forest Plan; only 12 are known to have been detected between 1998 and 2000, despite considerable pre-disturbance survey effort (USDA, USDI Species Review Panel 1999b and 2000b). This contributed to assignment of the Larch Mountain salamander to the rare category under the action alternatives during panel reviews in 2000 for this SEIS (USDA, USDI Species Review Panel 2000c). Historically, this species may have had a broader distribution throughout its current range. The current pattern is likely the result of millennia of natural disturbance events, including volcanism and fire, and decades of human-caused disturbances.

Distinct populations of the Larch Mountain salamander have been identified based on genetic diversity (Wagner et al. 2000). The Columbia River divides this species into two distinct groups, north and south. Currently, within each of these groups, the biological distribution is not known, but is likely a mix of isolated sites, isolated site clusters, and sites/clusters with limited connectivity. Additional sites in each group should be encountered with continued surveys, expanding knowledge of this species' distribution, but probably not changing the understanding of its biological distribution patterns (isolates, clusters, connectivity). Relative abundances at extant populations are not well known.

The reference distribution used in this analysis primarily reflects its current level of patchiness away from the Gorge and clustering within the Gorge. The reference distribution recognizes that there are likely to be additional undetected sites. Finally, the reference distribution considered that historically connectivity among sites or site clusters across suitable habitat (extant or in restoration) within each population segment was likely limited, both north and south of the Columbia River. This analysis is not divided between these north-south groups because the effects of the management alternatives are similar for each group.

This species is included in the Survey and Manage Standards and Guidelines due to its high site fidelity, low movement rate, long generation time, microclimate constraints, and association with late-successional or old-growth forest components (USDA, USDI 1994a and 2000). Generally, species in this genus are long-lived, slow to develop to sexual maturity, and have small clutch sizes (Houck 1977).

Habitat types are as originally described in the FEMAT Report and the Northwest Forest Plan Final SEIS (Appendix J2), including talus and rocky slopes with a dense conifer overstory (Herrington and Larsen 1985). Recent research information has found site characteristics that are much broader (Aubry et al. 1987 and USDA, USDI 2000). The species has a narrow range of microclimate requirements at all sites. The majority of known sites for this species reflects narrow habitat and microclimate requirements. The upper limit on elevation extent is 4,100 feet (1,250 meters).

Federally managed lands are important for this species (USDA, USDI 1994a). Of the 111 known sites, 67 sites are located on federally managed lands. Of those, 41 sites are located in Late-Successional Reserves, 4 sites in Administratively Withdrawn Areas, 7 sites in Congressionally Withdrawn Areas, 8 sites in Adaptive Management Areas, and 7 sites in Matrix (USDA, USDI Species Review Panel 2000b).

### **Environmental Consequences and Comparison of Alternatives**

All action alternatives would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution on federally managed lands within the Northwest Forest Plan area. Under all alternatives, all current and future known sites would be managed and pre-disturbance surveys would be required. These mitigation measures reduce the chance of inadvertent loss of sites from land management activities.

Under all alternatives, Riparian Reserves may provide incidental protection for Larch Mountain salamander populations near aquatic habitats. Activities within Riparian Reserves (e.g., unmanaged recreation activities) could adversely affect salamanders by direct habitat disturbance or by indirectly altering microclimate regimes.

This species is in Category 1A, 2A, and 3A under the action alternatives which require management of known sites, pre-disturbance surveys, and strategic surveys. Critical knowledge gaps would be filled through strategic surveys, resulting in accelerated adaptive management which is an advantage to both species conservation and management implementation. New information compiled from strategic surveys would be essential for refining and updating Survey Protocols and Management Recommendations. Strategic surveys could benefit species management by investigating potential source populations, habitat requirements, geographic range, location of extant sites, management effects, population demographics at known sites, and distribution of this species on reserve land allocations. The No-Action Alternative has no provision for strategic surveys for Larch Mountain salamanders. Adaptive management for Larch Mountain salamander is accelerated under all action alternatives in comparison to the No-Action Alternative.

Under the No-Action Alternative, Larch Mountain salamander is both a Protection Buffer species and managed under Category 2 of the Survey and Manage Standards and Guidelines. There is conflicting guidance between the Protection Buffer and the Survey and Manage Standards and Guidelines because management specified for both proposed activities and areas differ. The result is potential confusion and management inconsistencies that could have adverse effects on the maintenance of these salamanders at known sites.

Under the Protection Buffer Standards and Guidelines, all sites are provided a Managed Late-Successional Area land allocation with a standard buffer of 100 feet or one site potential tree height, whichever is larger. There is no allowance for determining a site-specific buffer. A smaller or no buffer might be warranted if a relatively benign action were proposed that were estimated to have a negligible effect on these salamanders. Costs of imposing unnecessary buffers is high under the No-Action Alternative. Conversely, if a greater buffer were needed at a site to maintain salamander micro-habitat (e.g., downed wood recruitment, slope stability, and hydrological regime) and microclimate (e.g., edge effects (Chen et al. 1995)), impacts on salamanders may be incurred ranging from effects on population demography to greater probability of site-level extirpation.

The No-Action Alternative contributes to the maintenance of populations on federally managed lands through management of all current and future known sites, but may not contribute to maintenance of gene flow among the scattered populations by not addressing connectivity of clustered sites. This loss of gene flow among isolated populations can lead to altered genetic diversity and can increase the probability of extirpation events. This increases uncertainty for projections of future distribution patterns under the No-Action Alternative. In contrast, all three action alternatives include strategic surveys which may gather the information necessary to

consider potentially important connectivity areas as “additional or in-lieu direction, subject to appropriate NEPA analysis.” However, this potential for managing connectivity in the action alternatives is speculative until additional information is gathered.

Management of known sites under Alternative 1, 2, and 3 would be similar. Although Alternative 3 states all occupied sites would be managed with a 250-meter buffer, draft Management Recommendations allow activities within this buffer if a proposed activity does not adversely affect the salamander or its habitat.

In conclusion, Alternatives 1, 2, and 3 would provide sufficient habitat (including known sites) to allow the Larch Mountain salamander to stabilize in a pattern similar to the reference distribution on federally managed lands within the Northwest Forest Plan area in the Cascade Range. The No-Action Alternative does not have a mechanism for filling critical knowledge gaps to assist with species management, nor a means to address potentially important connectivity corridors because of the lack of general regional surveys. Nevertheless, while there is a moderate level of uncertainty due to unknown effects, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. Uncertainty for all of these determinations also stems from restricted knowledge of this species’ population ecology and due to unknown effects of potential future catastrophic disturbances or stochastic processes.

## **Siskiyou Mountains Salamander (*Plethodon stormi*)**

### **Background and Affected Environment**

The Siskiyou Mountains salamander has a limited geographic range; it is found only in the OR and CA Klamath Physiographic Provinces. Since the implementation of the Northwest Forest Plan, the known range has been extended approximately 11 miles (18 kilometers) to the south, 10 miles (11 kilometers) east, and 7 miles (16 kilometers) west; including the addition of one or two populations south of the Klamath River. The known upper elevation limit has been extended to 6,000 feet (1,830 meters). The range has roughly doubled to over 321,000 acres (130,000 hectares) since 1993. The edge of the northern portion of the range is well delineated (USDA, USDI 2000); the southern edges of the range are not fully delineated and in some areas may intergrade, with no hybridization, with the Del Norte salamander (USDA, USDI Species Review Panel 2000b). Although knowledge of the species range has expanded, the known range remains limited to a small area near the Oregon/California border.

Currently, there are 187 known sites of this species. All occur within the general range of the Northwest Forest Plan, with 176 sites (94 percent) on federally managed lands and 50 sites (26 percent) are in Late-Successional Reserves or withdrawn land allocations. Most of the sites have been discovered by recent research and pre-disturbance surveys; 140 have been found since 1993. Sites reported prior to 1993 may no longer be extant, particularly on nonfederal lands, because of adverse impacts from land management activities on habitat and microclimate at these sites.

The distribution of sites within the geographic range appears different in Oregon and California. In Oregon, it is widespread but spotty within its range. In California, it appears to have more limited locations throughout its range. There is greater uncertainty regarding site distribution in California.

Currently, it is not definitively known how salamanders within sites or populations interact. However, this species appears to have a biological distribution of a few isolated sites and more frequent site clusters and sites/clusters with both limited and multiple avenues of connectivity. Clusters of sites and concurrent distribution of contiguous habitat appear to be arrayed geographically into 6 to 10 populations of the Siskiyou Mountains salamander (USDA, USDI Species Review Panel 2000b). The species appears to have a higher density of site localities and greater connectivity among sites in Oregon.

Preliminary results from a recent genetics study indicate that several sites in California show genetic divergences that may be species level differences. To date, the sites in Oregon do not show such genetic differences (USDA, USDI Species Review Panel 2000b). Potential loss of genetic diversity is a particular concern if unique populations are lost, regardless of the extent of future taxonomic revisions. These data bear on estimations of biological distribution patterns in Oregon and California. In Oregon, where there is no support for genetic divergence among sites, a high degree of connectivity and a potential population bottleneck are suggested. High connectivity is further supported by the spatial distribution of known sites and habitat which support more homogeneous coverage of the range in Oregon. In California, the genetic divergences noted suggest that populations are not well connected.

The species' range covers 337,389 acres (136,595 hectares) of both federally managed and nonfederal lands (USDA, USDI Species Review Panel 2000b) and is approximately distributed as follows: 4 percent within Congressionally Reserved areas; 7 percent within Administratively Withdrawn Areas; 27 percent within Late-Successional Reserves; 38 percent within Adaptive Management Areas; and 9 percent within Matrix/Riparian Reserves. The remaining 15 percent is located on nonfederal lands (USDA, USDI Species Review Panel 1999b).

In Oregon, this salamander occurs in an Adaptive Management Area (about one-third of the total range and two-thirds of the known sites). All the above-mentioned allocations occur in California, with that portion of the species' range on federally managed lands being dominated by Late-Successional Reserves (27 percent of the range, overall, and 20 percent of the known sites).

The reference distribution for the Siskiyou Mountains salamander recognizes different distribution patterns in Oregon and California. Between the states (1) the distribution pattern of known sites differs; (2) the genetic structure of the populations appears to differ; (3) the biological distribution of sites and their connectivity appear to differ; and, (4) the array of federal land allocations within the species range differ. The reference distribution includes a recognition that additional sites are likely undetected. The reference distribution also recognizes that historically connectivity among sites or site clusters, or multiple avenues of connectivity, across suitable habitat (extant or in restoration) was likely limited within each potential population segment.

Known habitat for this species is as originally described in the Northwest Forest Plan Final SEIS: forested rocky substrates under a closed canopy that provides cool, moist microclimates suitable for salamander surface activity. More comprehensive habitat models are available through recent research (USDA, USDI Species Review Panel 2000b). At such sites, the layers of loose, rock material (soil and substrate) may be a surrogate for the canopy relative to microclimate buffering (deMaynadier and Hunter 1995). The species can occur in all seral stages, but the majority of sites are in older forest (mature and old-growth) and abundances are higher in older forests (USDA, USDI Species Review Panel 2000b and Nussbaum 1974). Average canopy closure on occupied sites was 78 percent (USDA, USDI Species Review Panel 2000b).

Habitat in the form of rocky substrates is relatively widespread throughout the range of the species, is often patchy in its distribution, and is highly variable in patch size and contiguity (USDA, USDI Species Review Panel 2000b and USDA, USDI 2000). Occupancy rates in suitable habitat are low, ranging from 20 percent south of the Siskiyou Crest in California to 30 percent north of the Siskiyou Crest in Oregon (Ollivier et al., unpubl. data).

Overall, this species is included in the Survey and Manage Standards and Guidelines due to: (1) its high site fidelity and low movement rate; (2) narrow habitat and microclimate requirements; (3) patchy habitat distribution across the known range; (4) patchy distribution among sites containing suitable habitat; (5) limited range within the Northwest Forest Plan area; and, (6) the sensitivity of the species and its required habitat elements to adverse disturbance effects (Welsh and Lind 1992; USDA, USDI 1994a and 2000; and USDA, USDI Species Review Panel 2000b). Species in this genus are long lived, slow to develop to sexual maturity, and have small clutch sizes (Houck 1977).



## Environmental Consequences and Comparison of Alternatives

The Siskiyou Mountains salamander is in Category 1C, 2D, and 3B under the action alternatives. Alternative 2 results in substantial effects and uncertainty on Siskiyou Mountains salamanders, compared to the other three alternatives. Alternatives 1 and 3 provide the best assurance for provision of sufficient habitat (including known sites) to allow the species to stabilize in a pattern different from the reference distribution. Rationale for these conclusions are explained below.

Under all alternatives, Riparian Reserves may provide incidental protection for Siskiyou Mountains salamander populations near aquatic habitats. Activities within Riparian Reserves (e.g., unmanaged recreation activities) could adversely affect salamanders by direct habitat disturbance or by indirectly altering microclimate regimes.

Under the No-Action Alternative, the Siskiyou Mountains salamander is both a Protection Buffer species and managed under Categories 1 and 2 of the Survey and Manage Standards and Guidelines. The No-Action Alternative would require pre-disturbance surveys and management of current and future known sites.

Under the No-Action Alternative, there is conflicting guidance between the Protection Buffer Standards and Guidelines for known sites, and the Survey and Manage Standards and Guidelines because management specified for both activities and areas differ. The result is potential management inconsistencies that could have adverse effects on the maintenance of these salamanders at known sites. All sites are provided a Managed Late-Successional Area land allocation with a single size buffer of 100 feet, or one site potential tree height, whichever is larger. This uniformly applied buffer does not allow for determining a site-specific buffer. A smaller or no buffer might be warranted if an action were proposed that had negligible effects. Costs of imposing unnecessary buffers is high under the No-Action Alternative. If a larger buffer were needed to maintain salamander micro-habitat (e.g., down wood recruitment, slope stability, and hydrology) and microclimate (e.g., edge effects (Chen et al. 1995)), losses of salamanders might be incurred by the No-Action Alternative. The result of such losses might range from effects on population demography to a greater probability of site-level extirpation.

The No-Action Alternative contributes to the maintenance of populations of this species on federally managed lands through management of all current and future known sites, but may not contribute to maintenance of gene flow among the scattered populations of this species in its range by addressing connectivity of clustered sites. This loss of gene flow among isolated populations can lead to altered genetic diversity and can increase the probability of extirpation events. In contrast, all three action alternatives include strategic surveys which may gather the information necessary to consider potentially important connectivity areas as “additional or in-lieu direction, subject to appropriate NEPA analysis.” However, this potential for managing connectivity in the action alternatives is speculative until additional information is gathered.

Under Alternatives 1 and 3, pre-disturbance surveys would be conducted to minimize the inadvertent loss of undiscovered sites, and management of all current and future known sites are required until high-priority sites are determined. Draft Management Recommendations would apply before site prioritization occurred and, subsequently, would likely apply to high-priority sites. Guidance included in draft Management Recommendations provides a mechanism for management flexibility to allow management within buffers if a proposed activity does not adversely affect the salamander or its habitat. Effects of management on Siskiyou Mountains salamander are expected to be the same for Alternatives 1 and 3.

Under Alternatives 1 and 3, only high-priority sites would be identified for management. A range of approaches might be considered for non-priority sites. This could span from approaches that are designed to maintain the animals at a site (i.e., application of draft Management Recommendations) to approaches that might result in site-level extirpation. This species is uncommon, as opposed to rare, and could reasonably be maintained with only a proportion of its known sites managed. At the remaining known sites, activities would be permitted that could have

adverse effects to the salamander and its habitat, but would not adversely affect the species stability and distribution across its range over the long term. The prioritization criteria are not currently developed, but are likely to include important population centers (sites or clusters of sites) that provide repopulation sources (Wilcox 1980) and unique site protection to maintain genetic, morphologic, and ecotypic diversity. Maintenance of a high likelihood of salamander survival could occur at spatial scales intermediate between a site and the species' range, for example to maintain identified "populations." This management strategy is not restricted to the individual site scale, but considers adjacent habitats and populations during site management decisions. Connectivity among clusters of sites can be considered under these alternatives. In Oregon, there is a moderate level of uncertainty regarding how site prioritization would be implemented in the Adaptive Management Area. Thus, the resulting effects on sites and populations are more uncertain in comparison to California, with its higher proportion of sites and range within reserve land allocations.

A site management provision in Alternatives 1 and 3 is that non-priority sites can be identified locally prior to issuance of Management Recommendations. There is a likelihood of site losses for this salamander, and possible losses at larger scales if an important source habitat, link between populations, or unique site were approved as non-priority. Knowledge relating to the value of sites or certain areas for population structure and dynamics with regard to unique areas is lacking. This is a new priority for research and management, and few resources have previously been applied to this question. Susceptibility to adverse effects of important populations of this species is reduced by the process for non-priority site proposals to have oversight by the Interagency Survey and Manage Program Manager, in consultation with species specialists and neighboring administrative units.

The trade-off between site management under the No-Action Alternative and Alternatives 1 and 3 is the difference between management of all sites, now and in the future (under No-Action), and prioritization of sites with consideration of adjacent habitats, connectivity, and multiple spatial scales (under Alternative 1 and 3). Providing sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution is likely under both approaches. Over the long term, some sites under the No-Action Alternative would be lost due to the increased probability of extirpation of isolated populations, through loss of genetic diversity, unmanaged disturbances, catastrophes, and stochastic processes. Over the long term, some sites would likely undergo unique evolutionary trajectories, potentially increasing the biological diversity of this salamander across its range. Clusters of sites and sites associated with reserves are more likely to continue as stable entities, due to greater connectivity likelihoods. Due to the distribution of reserved lands to the south of this species' range, and the clustering of sites in the north, populations in both areas should be maintained barring catastrophic events.

Under Alternatives 1 and 3, sites that are lost would be largely chosen by managers and taxa experts. In the short-term, lost sites under Alternatives 1 and 3 likely would outnumber potentially lost sites under the No-Action Alternative. However, managed sites have a greater likelihood of long-term maintenance because multi-scale approaches linking site-level to population-level salamander survival, can be applied. Animals at sites chosen for intermediate impact levels might fluctuate in distribution and abundance over time, and some would likely survive. Without greater knowledge of the population ecology of this species, relative to various spatial scales and management trajectories, it is difficult to estimate which of these scenarios is more protective based on site management alone. However, inclusion of strategic surveys under Alternatives 1 and 3 provides an advantage for species management and provides an important mechanism for refining species management.

All three action alternatives include strategic surveys. Critical knowledge gaps would be filled with this measure, resulting in accelerated adaptive management, an advantage to both species conservation and management implementation. New information compiled from strategic surveys would be essential for refining and updating Survey Protocols and Management Recommendations. Strategic surveys could benefit species management by investigating potential source populations, habitat requirements, geographic range, location of extant sites, management

effects, population demographics at known sites, and distribution of this species in reserve land allocations. The No-Action Alternative has no provision for strategic surveys. Adaptive management for Siskiyou Mountains salamander is accelerated under all action alternatives in comparison to the No-Action Alternative: information gaps would be filled quicker and conservation strategy development would be on a faster track. This is a benefit of all action alternatives over the No-Action Alternative.

Under Alternative 2, all known sites and presumed occupied sites located as of September 30, 1999, would be managed for the Siskiyou Mountains salamander for 5 years. No pre-disturbance surveys would be required and no new known sites would be managed. Strategic surveys would be completed in 5 years. Based on available information in 5 years, this species would be assigned to the Agencies' special status species programs or removed from special management consideration. Several adverse effects to the species stem from this alternative.

Under Alternative 2, sites discovered after September 30, 1999, would not be managed. This would result in loss of occupied sites from land management activities; some are likely to be important for the maintenance of populations of this species at local to landscape spatial scales. This is important because large areas of the species' range remains unsurveyed. Under this alternative, there is no mechanism in place to maintain unique populations or sites in key areas that are identified during strategic surveys or by other means over the 5-year interval. The extent or magnitude of this effect to the species is difficult to characterize because of incomplete information, and unavailable projections of rates of disturbances within this species' range.

After 5 years, the fate of this species is uncertain under Alternative 2. It would be removed from the Survey and Manage Standards and Guidelines, and it would be determined, based on the existing knowledge at that time, whether it would be included under the Agencies' special status species programs or removed from special management consideration. Interim guidance requires that known sites be managed until such a determination is made. For the Siskiyou Mountains salamander, because of the numbers of sites (69 percent), the proportion of the range in managed land allocations (47 percent, in USDA, USDI 1999b), and the geographic distribution of reserve land allocations relative to its range, there is a high likelihood of adverse effects in Oregon under Alternative 2. In the absence of any additional special management consideration for this species in Matrix and Adaptive Management Areas, human-caused disturbances in those areas may not provide adequate habitat to maintain the species. In Oregon, vulnerability to such losses is exceptionally high, due to the dominance of the Adaptive Management Area land allocation within this species' range on federally managed lands. In California, an altered distribution of sites is projected, because the presence of reserve land allocations reduces the likelihood that localized populations would become extirpated. It is likely that in California habitat would be managed to allow the species to stabilize, but in a pattern different from its reference distribution. In particular, sites in the southeast portion of the species' range in California likely would be affected, due to Matrix lands in this area.

The different patterns between Oregon and California roughly corresponds to federal administrative units; in California, the Klamath National Forest is in Forest Service Region 5 and the Rogue River National Forest, mostly in Oregon, is in Forest Service Region 6. Within the species range, the Rogue River National Forest extends slightly into California, with both Adaptive Management Area and Late-Successional Reserve land allocations. Because of the provision in the National Forest Management Act (i.e. to maintain habitat to support viable populations of native vertebrate species within a planning area (e.g. a National Forest)), it is reasonably foreseeable that, after 5 years, some special management consideration would be given to the Siskiyou Mountains salamander in this portion of its range. This species could be maintained in Region 6 within the Late-Successional Reserve allocation in California (approximately one-quarter township or 5,700 acres), due to potentially reduced adverse effects of forest management in this reserve land allocation. It is also possible that the species would be managed for a broader distribution in Region 6 such that sites or populations would be retained in the Adaptive Management Area in Oregon. Interpretation of this viability provision is not explicit and can vary, leading to a high uncertainty of a reasonable future distribution pattern for this

species in Oregon and Region 6. Nevertheless, the species distribution across the lands in Region 6 is likely to be retained, and its distribution across Adaptive Management Area lands are likely to be greatly altered from the reference condition.

Although reserve land allocations may offer some interim protection for this species, common restoration activities in reserves may impact salamanders by adversely affecting microclimate and other habitat requirements. For example, in Late-Successional Reserves, thinning in stands less than 80 years old to accelerate late-successional or old-growth forest development disturbs suitable habitats and reduces canopy closure below levels likely to maintain this species (Welsh and Lind 1995 and USDA, USDI 2000). Under Alternative 2, Siskiyou Mountains salamander would be most secure within Congressionally Withdrawn Areas; less secure in Administratively Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves; and least secure in Adaptive Management Areas and Matrix. The reason for this descending order of security is because the level and extent of management activities that could lead to adverse effects on salamanders varies within these land allocations.

Approximately 47 percent of the Siskiyou Mountains salamander range is located in Adaptive Management Areas, Matrix, and Riparian Reserves land allocations and is subject to management activities that have the potential to cause loss of sites. Riparian Reserves within the Matrix reduce some of this exposure to management activities, although this is not a riparian-dependent species. There is a clustered geographic distribution of these allocations within the species' range. Importantly, an Adaptive Management Area occurs in the northern half of the species' range, and contains 67 percent of the known sites. This would be an area in which salamanders would be susceptible to losses if protective measures were lifted in 5 years. Overall, the percentage of the known range subjected to potential loss of sites may result in a substantial degree of vulnerability to the maintenance of Siskiyou Mountains salamander populations and range under Alternative 2.

In 5 years of strategic surveys under Alternative 2, only limited new knowledge about this species could be acquired. Information that could be reliably acquired in that timeframe includes: species distribution in reserve land allocations; distribution of sites; distribution of habitat in reserve land allocations; and range extent. If field surveys go beyond first-detection of the species at a site, estimates of abundance categories for this species can be made. Multiple site visits would reduce variation in such categorization due to sporadic surface activity patterns. It is unlikely that a comprehensive demographic profile across the species range would be possible within 5 years because some parameters (e.g., population dynamics) require more time for reliable estimation. Identification of potentially important high-priority sites based on genetics, morphology, ecological characteristics, and relative values of sites in a population dynamic model would depend on considerable resources allocated to such studies. Alternatives 1 and 3 do not have this 5-year time limit on completing strategic surveys, and management decisions can be iterative based on accumulating knowledge over a longer timeframe.

Under Alternative 2, managed known sites includes presumed occupied sites. This is important because some field units have screened lands for suitable Siskiyou Mountains salamander habitat in order to streamline forest management. In lieu of surveying for salamanders at a likely site they presumed occupancy based on suitable habitat. In these areas, there is a high probability of occurrence of these animals. Unless surveys were to occur and no salamander detections found, these areas are expected to remain as presumed occupied and managed as such.

In conclusion, in Oregon, while there is a moderate level of uncertainty due to lack of knowledge regarding how site prioritization would affect salamanders, Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. In California, due to the greater distribution of reserve lands, there is less uncertainty regarding known site prioritization, and Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. The No-Action Alternative does not have a mechanism for filling critical knowledge gaps to assist with species management, nor a means to address potentially important connectivity corridors because of the lack of general regional surveys. Both population and connectivity

maintenance would have greater assurance in California, where reserve land allocations are located; in Oregon, there would be more uncertainty because more federally managed lands occur in the Adaptive Management Area land allocation. In Oregon, while there is a moderate level of uncertainty due to unknown effects, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. In California, the No-Action Alternative would likely provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to the reference distribution. Under Alternative 2, due to unknown management after 5 years and the differences in land allocations between Oregon and California, the species' outcomes are projected to differ between Oregon (Region 6, Forest Service) and California (Region 5, Forest Service). In Oregon, while there is a high level of uncertainty due to the future management of the Applegate Adaptive Management Area relative to Siskiyou Mountains salamanders, Alternative 2 would likely provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from its reference distribution. In California, while there is a moderate-to-high level of uncertainty due to lack of knowledge of future federal land management, Alternative 2 likely would provide habitat (including known sites) sufficient to allow species to stabilize in a pattern different from the reference distribution. Uncertainty for all of these determinations stems from our restricted knowledge of this species' population ecology and from the unknown effects of potential future catastrophic disturbances or stochastic processes. Catastrophic disturbances and stochastic events could have a disproportionately more severe effect on this species due to its extremely small known range.

## Del Norte Salamander (*Plethodon elongatus*)

### Background and Affected Environment

This species has a limited range, being endemic to western forests in southwestern Oregon and northwestern California, occurring in the OR and CA Klamath and CA Coast Physiographic Provinces. Survey efforts since 1993 for Del Norte salamanders have increased the known range 5 miles (8 kilometers) north and 20 miles (32 kilometers) east. The known upper elevation limit has been expanded to 5,700 feet (1,737 meters). The edges of the known range are not well delineated.

Within the range, distribution of this species is widespread but spotty. It appears that sites are more widespread and even towards the center, coastal portion of the range; sites become more limited north, south, and east (Nauman pers. comm.).

Currently, there are 700-1000 known sites of this species. Using a convex polygon method to determine range area covered by sites, this species occurs over 1,419,362 acres (574,408 hectares) of both federally managed and nonfederal lands (USDA, USDI Species Review Panel 2000b). Data quality assurance issues prohibit a better estimate of known sites at this time. Many sites have been discovered by recent pre-disturbance surveys (266 of 882 since 1993; USDA, USDI Species Review Panel 1999b). Sites identified prior to 1993 may no longer be extant because of possible adverse impacts from land management activities on habitat and microclimate.

The biological distribution of this species is not well known, but likely both historically and currently is comprised of a mix of isolated sites, isolated site clusters, sites/clusters with limited connectivity, and sites/clusters with multiple avenues of connectivity. This pattern can be estimated from current known site maps (USDA, USDI 1999).

The reference distribution for this species can be represented by the current distribution, while recognizing that not all sites have been detected and site density and range limits are not fully known.

Estimates of population numbers across the species range are not available. Relative abundances during recent surveys in later-seral habitats appear to average about 0.01 animals per square meter;

abundances above 0.04 animals per square meter represents a dense site. A single site studied by Welsh and Lind (1992), having the largest capture rates in their more extensive surveys, had 0.3 to 1.5 animals per square meter as determined by mark-recapture models.

Federally managed lands figure prominently within the range of this species (USDA, USDI 1994a). Currently, 689 of 882 sites (72 percent) and 70 percent of the known range are on federally managed lands. The 689 sites are distributed among the various land allocations in the following proportion: 33 (4 percent) are in Adaptive Management Area; 314 (36 percent) are in Matrix; 270 (31 percent) are in Late-Successional Reserves; 38 (4 percent) are in Administratively Withdrawn Areas; and 34 (4 percent) sites are in Congressionally Withdrawn Areas. About 26 percent of the known range is Late-Successional Reserve, 5 percent is Administratively Withdrawn Areas, and 21 percent is Congressionally Withdrawn Areas (USDA, USDI Species Review Panel 1999b).

Genetic and morphologic studies have reported unique populations of this species. Potential loss of genetic diversity is a concern if unique populations (e.g., evolutionarily significant units or distinct population segments) are adversely affected by management. Clarification of such diversity is a priority for incorporation into the development of effective management approaches.

New information since 1994 has identified attributes that are important to survival of these salamanders, including several micro-habitat and microclimate conditions of old-growth or late-successional forest (Feder 1983; USDA, USDI Species Review Panel 2000b; and USDA, USDI 2000). The species can occur in all seral stages, but abundance in northwestern California is higher in older forests (Welsh and Lind 1995). Habitat in the form of rocky substrates is relatively widespread throughout the range, but is often patchy in distribution and is variable in patch size and contiguity. At such sites, the layers of loose, rock material (soil and substrate) may be a surrogate for the canopy relative to microclimate buffering (deMaynadier and Hunter 1995 and USDA, USDI 2000). Riparian Reserves would only provide protection for this species if suitable habitat incidentally occurred in such areas.

The Del Norte salamander is included in the Survey and Manage Standards and Guidelines due to: (1) its high apparent site fidelity and low dispersal rate; (2) narrow habitat and microclimate requirements; (3) patchy habitat distribution across the known range; (4) patchy distribution among sites containing suitable habitat; (5) limited overall range relative to the Northwest Forest Plan area; and, (6) the sensitivity of both the species and its required habitat elements to adverse disturbance effects (Welsh and Lind 1992 and USDA, USDI 2000). Species in this genus are long-lived, slow to develop to sexual maturity, and have small clutch sizes (Houck 1977).

### **Environmental Consequences and Comparison of Alternatives**

The Del Norte salamander is in Category 1D, 2D, and 3B in the action alternatives. Under the action alternatives, this species is categorized as uncommon and pre-disturbance surveys are not required. Alternative 2 results in comparatively higher losses of Del Norte salamanders, whereas the remaining three alternatives provide a greater assurance of the maintenance of habitat and populations across the species' range.

Under all alternatives, Riparian Reserves may provide incidental protection for Del Norte salamander populations near aquatic habitats. Activities within Riparian Reserves (such as unmanaged recreation activities) could adversely affect these salamanders by direct habitat disturbance or by indirectly altering microclimate regimes.

Under the No-Action Alternative, the Del Norte salamander is both a Protection Buffer species and managed under Category 2 of the Survey and Manage Standards and Guidelines. The No-Action Alternative would require pre-disturbance surveys and management of current and future known sites.

There is conflicting guidance between the Protection Buffer Standards and Guidelines for known sites, and the Survey and Manage Standards and Guidelines because management specified for both activities and areas differ. The result is a moderate uncertainty regarding which management guidelines would be implemented, potential management inconsistencies, and potential management that could have adverse effects on the maintenance of these salamanders at known sites.

Under Protection Buffer Standards and Guidelines, sites are provided a Managed Late-Successional Area. The 40 percent post-disturbance canopy cover prescribed by the Protection Buffer Standards and Guidelines at occupied sites is likely to be too low to provide assurance for salamander survival. Unsuitable microclimate conditions are expected from such management. Studies have indicated that suitable habitats for Del Norte salamander generally included more than 70 percent canopy cover (Welsh and Lind 1995; USDA, USDI Species Review Panel 2000b; and USDA, USDI 2000). Losses of salamanders at sites managed with this prescription may occur, with extirpation at these sites and a diminished distribution across its range. There is uncertainty regarding the effects over the long term of thinning to these levels. Further research is needed to ascertain forest thinning effects on these salamanders, and the interacting roles of geographic location and other site conditions.

Under Protection Buffer Standards and Guidelines, sites are uniformly provided a buffer of 100 feet, or one site potential tree height, whichever is larger. Protection Buffer Standards and Guidelines do not allow for determining a site-specific buffer. A smaller or no buffer might be warranted, if an action were proposed that had a negligible effect on these salamanders. Costs of imposing unnecessary buffers is high under the No-Action Alternative. If a larger buffer were needed to maintain salamander micro-habitat (e.g., down wood recruitment, slope stability, and hydrology) and microclimate (e.g., edge effects (Chen et al. 1995)), effects on salamander survival and/or reproduction would likely be incurred. Such an effect ranged from altered population demography to greater probability of site-level extirpation.

Under the No-Action Alternative, the draft Management Recommendations are written to maintain salamanders at each known site. If such an approach were employed, the above adverse effects of the Protection Buffer guidelines (e.g., loss of animals at sites due to inadequate provisions) would be moot. Currently, there is uncertainty which guidelines would be implemented.

The No-Action Alternative (either Protection Buffer guidelines or the draft Management Recommendation) contributes to the maintenance of populations of this species on federally managed lands through management of all current and future known sites, but may not contribute to maintenance of gene flow among the scattered populations of this species in its range by addressing connectivity of clustered sites. This loss of gene flow among isolated populations can lead to altered genetic diversity and can increase the probability of extirpation events. In contrast, all three action alternatives include strategic surveys which may gather the information necessary to consider potentially important connectivity areas as “additional or in-lieu direction, subject to appropriate NEPA analysis.” However, this potential for managing connectivity in the action alternatives is speculative until additional information is gathered.

Under Alternatives 1 and 3, only high-priority sites would be identified for management. This would result in a range of site-level effects on Del Norte salamander survival, from approaches that are designed to maintain salamanders at sites (i.e., application of draft Management Recommendations) to approaches that likely would result in site-level extirpation. This species is uncommon, as opposed to rare, and could reasonably be managed over the long term with only a proportion of its known sites managed. At the remaining known sites, activities could be permitted that would have adverse effects to the salamander and its habitat, but would not adversely affect the species’ stability and distribution across its range. High to intermediate site-impact approaches might be employed for non-priority sites. The prioritization criteria are not currently developed, adding considerable uncertainty to this approach, but are likely to include important population centers (sites or clusters of sites) that provide repopulation sources (Wilcox 1980) and unique site protection to maintain genetic, morphologic, and ecotypic diversity.

Maintenance of the species could occur at spatial scales intermediate between a site and the species' range, for example to maintain identified "populations." This management strategy may not be restricted to the individual site scale, but might consider adjacent habitats and populations during site management decisions. Connectivity among clusters of sites can be considered under these alternatives.

Under Alternatives 1 and 3, draft Management Recommendations would apply before site prioritization occurred and would likely apply to high-priority sites. Draft Management Recommendations allow management within buffers, if a proposed activity does not adversely affect the salamander or its habitat.

A site management provision in Alternatives 1 and 3 is that non-priority sites can be locally identified prior to issuance of Management Recommendations. There is considerable uncertainty regarding the effects of this provision. There is concern for the survival of salamanders at larger scales than a single site, if an important source population or critical habitat link between populations were identified as non-priority. Cumulative effects of multiple such decisions could have escalating impacts. Similarly, there is concern if a unique site (morphological or genetically) were approved as non-priority. Knowledge of the value of sites or certain areas for population structure and dynamics and with regard to unique areas needs to be incorporated into site-level decisions. The process for non-priority site proposals to have oversight by the Interagency Survey and Manage Program Manager, in consultation with species specialists and neighboring administrative units, is expected to dampen potentially serious consequences of non-priority site identification without consideration of the biological value of sites within multiple contexts. Overall, there is uncertainty as to how this process would be implemented, and with lack of species knowledge, how such decisions would be made and what would be their consequences for salamander survival at scales larger than individual sites.

The action alternatives do not include pre-disturbance surveys for this species. This would result in loss of sites from management activities; some of which are likely to be important for local to regional survival of Del Norte salamanders. This is important because large areas of the species range remain unsurveyed. The extent or magnitude of this effect on the species is difficult to characterize because of incomplete information and unavailable projections of rates of disturbances within this species' range.

Under the action alternatives, managed known sites include presumed occupied sites. This is an important clause because some field units have screened lands for suitable Del Norte salamander habitat in order to streamline forest management activities. In lieu of surveying for salamanders at a likely site, they presumed occupancy based on suitable habitat. In these areas, there is a high probability of occurrence of these animals. Unless surveys were to occur and no salamander detections found, these areas remain as presumed occupied and managed as if they were occupied.

Under Alternative 1 and 3, managed known sites includes any new sites discovered through strategic surveys or other means. This is an advantage for the species over Alternative 2, which only includes management of sites found prior to September 30, 1999.

The difference between site management under the No-Action Alternative (using draft Management Recommendations and not Protection Buffer standards) and Alternatives 1 and 3 is the difference between management of all sites (under No-Action) now, and in the future, and prioritization of sites with consideration of adjacent habitats, connectivity, and multiple spatial scales (under Alternative 1 and 3). Over the long term, some sites under the No-Action Alternative would be lost due to the increased probability of extirpation of isolated populations, through loss of genetic diversity, unmanaged disturbances, catastrophes, and stochastic processes. Some sites would likely undergo unique evolutionary trajectories, increasing the diversity of this salamander across its range. Clusters of sites and sites associated with reserves are more likely to continue as stable entities, due to greater connectivity likelihoods. Under Alternatives 1 and 3, sites that are lost are largely chosen by managers and taxa experts. Lost sites under Alternatives 1 and 3 likely would outnumber potentially lost sites under the No-Action Alternative. Salamanders



at maintained sites could have a greater likelihood of long-term survival because multi-scale approaches, site-level to population-level designs, can be applied. Animals at sites chosen for intermediate-level approaches might fluctuate in distribution and abundance over time, and some would likely prevail. Without greater knowledge of the population ecology, relative to various spatial scales and management trajectories, it is difficult to estimate which of these scenarios results in a scenario more closely resembling the reference distribution based on site management alone. Inclusion of the strategic survey provision under Alternatives 1 and 3 provides an advantage for species management, and provides an important edge for a species pattern more similar to the reference distribution under Alternatives 1 and 3.

All three action alternatives include strategic surveys. Critical knowledge gaps would be filled with this measure, resulting in accelerated adaptive management, an advantage to both species conservation and management implementation. New information compiled from strategic surveys would be essential for refining and updating Survey Protocols and Management Recommendations. Strategic surveys could benefit species management by investigating potential source populations, habitat requirements, geographic range, location of extant sites, management effects, population demographics at known sites, and distribution of this species on reserve land allocations. The No-Action Alternative has no provision for strategic surveys for these salamanders. Adaptive management for Del Norte salamander is accelerated under all action alternatives in comparison to the No-Action Alternative: information gaps would be filled quicker and conservation strategy development would be on a faster track. This is a benefit of all action alternatives over the No-Action Alternative.

Under Alternative 2, all known sites and presumed occupied sites located as of September 30, 1999, would be managed for 5 years. No pre-disturbance surveys would be required, and no new sites would be managed. Strategic surveys would be completed in 5 years. Based on available information in 5 years, these species would be assigned to the Agencies' special status species programs or removed from special management consideration. If assigned to the special status programs, its management is unknown, making it difficult to ascertain future distribution across the species' range. Interim guidance requires that known sites be managed until such determination is made. For Del Norte salamanders, about half the known range is in reserve land allocations. However, at this time, distribution of suitable habitat, extant known sites, and populations in reserves are unknown. It is likely that a proportion of those lands are suitable for this species; it is also likely that reserves do not provide a broad spatial coverage across the species range, nor co-occur with unique populations or taxonomic entities within the species. Substantial losses of Del Norte salamanders could be expected and there could be considerable effects on the species distribution across its range. Upon examination of the current distribution of Del Norte salamanders relative to land allocations, over one-half of sites could potentially be extirpated under Alternative 2. Due to the distribution of reserve land allocations, losses of sites can be anticipated throughout its entire range, both latitudinally and longitudinally, with a skeleton of protected areas retained mid-range. This projected spatial configuration leads to the determination that the species reference distribution throughout its range on federally managed lands within the Northwest Forest Plan area would be altered by Alternative 2.

Common management proposals for restoration purposes may adversely affect salamanders by altering microclimate and other habitat conditions. For example, in Late-Successional Reserves, thinning in stands less than 80 years old to accelerate late-successional or old-growth forest development disturbs suitable habitats and reduces canopy closure below levels likely to maintain this species (Welsh and Lind 1995 and USDA, USDI 2000). Under Alternative 2, Del Norte salamander would be most secure within Congressionally Withdrawn areas; less secure in Administratively Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves; and least secure in Adaptive Management Areas and Matrix. The reason for this descending order of security is because the level and extent of management activities that could lead to adverse effects on salamanders at sites varies within these land allocations. Effects on animals in reserves would occur as management activities were implemented, unless a subsequent species management plan prohibited such impacts. About one-quarter of the species range occurs in the two most secure areas, Congressionally and Administratively Withdrawn Areas.

Under Alternative 2, with 5 years of strategic surveys, only limited new knowledge can be acquired. Information that can be reliably acquired in that timeframe includes: (1) species distribution in reserve land allocations; (2) distribution of sites; (3) distribution of habitat in reserve land allocations; and, (4) range extent. If field surveys go beyond first-detection of the species at a site, estimates of abundance categories for this species can be made. Multiple site visits would reduce variation in such categorization due to sporadic surface activity patterns. It is unlikely that a comprehensive demographic profile across the species range would be possible within 5 years because some parameters (e.g., population dynamics) require more time for reliable estimation. Identification of potentially important high-priority sites based on genetics, morphology, ecological characteristics, and relative values of sites in a population dynamic model would depend on considerable resources allocated to such studies. Alternatives 1 and 3 do not have this 5-year time limit on completing strategic surveys. Therefore, under these two action alternatives, management decisions can be iterative based on accumulating knowledge over a longer timeframe, rather than rushed for a single decision point based on limited knowledge.

In conclusion, while there is a high level of uncertainty due to both an unknown effect of site losses due to the lack of pre-disturbance surveys and open-ended process for known site prioritization, Alternatives 1 and 3 likely would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution. While there is a high level of uncertainty due to an unknown management after 5 years, Alternative 2 appears to provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern altered from its reference distribution. This pattern could be islands of sites and populations coincident with suitable habitats in reserve land allocations within the species range. Effects differ under the No-Action Alternative between the Protection Buffer guidance and the draft Management Recommendations. The Protection Buffer guidance prescribes thinning levels that may alter microclimate conditions and have adverse effects on salamanders. Although salamanders at some sites may survive, many losses might occur. A reasonably foreseeable scenario might be similar to Alternative 2, where islands of sites and populations are maintained coincident with suitable habitats in reserve land allocations within the species range; however, management activities that alter microclimates could be implemented within reserves for restoration purposes. With either the Protection Buffer guidelines or the draft Management Recommendations, the No-Action Alternative does not have a mechanism for filling critical knowledge gaps to assist with species management, nor a means to address connectivity corridors because of the lack of general regional surveys. Thus, under the Protection Buffer standards, while there is a high level of uncertainty, the No-Action Alternative likely would provide habitat (including known sites) sufficient to allow the species to stabilize in a pattern different from the reference distribution. Using draft Management Recommendations under the No-Action Alternative, while there is a moderate level of uncertainty due to the effects of lack of connectivity and prevalence of knowledge gaps, sufficient habitat (and known sites) likely would be provided to allow the species to stabilize in a pattern similar to the reference distribution. Uncertainty for all of these determinations also stems from our restricted knowledge of this species' population ecology and due to unknown effects of potential future catastrophic disturbances or stochastic processes.

## **Late-Successional Birds**

### **General Discussion**

The following section describes the background, affected environment, environmental consequences and comparison of the alternatives for bird species that are closely associated with late-successional forests. In the general discussion, the overall effects to late-successional birds is presented. Following the general discussion, effects to two species (northern goshawk and great gray owl) and one taxa group (four species of cavity nesters) are described because the action alternatives propose to modify their existing management direction.

## **Background and Affected Environment**

The Northwest Forest Plan Final SEIS and its supporting documents addressed the habitat needs of 36 bird species which were identified as closely associated with late-successional and old-growth forests. The majority of those species were assessed by FEMAT and found to be adequately provided for by Alternative 9 of the Northwest Forest Plan Final SEIS (the selected alternative) (USDA, USDI 1994a, Table 3&4-29, p. 3&4-179). These positive assessments for the late-successional bird species were due to the provision of Congressionally Withdrawn Areas, Late-Successional Reserves, Riparian Reserves, watershed analysis, and the retention of green trees, snags, and coarse woody debris in areas of timber harvest in Matrix and Adaptive Management Area land allocations. (See pp. 3&4-177 through 3&4-179 of the Northwest Forest Plan FSEIS for an explanation of the 1994 assessment ratings.)

There is no new information or changed circumstances to alter the conclusions for 30 of the 36 late-successional birds addressed in the Northwest Forest Plan Final SEIS. New information exists for the northern goshawk, black-backed woodpecker, white-headed woodpecker, pygmy nuthatch, flammulated owl, and great gray owl (see following discussions). In general, there has been a slight beneficial effect because of lower harvest levels than those anticipated in the Northwest Forest Plan Record of Decision. This has resulted in slightly less habitat loss than anticipated.

In 1998, the U.S. Fish and Wildlife Service conducted a status review for the northern goshawk. The status review concluded that listing the goshawk as a threatened or endangered species was not warranted. In reaching that conclusion, the status review looked at the current management of federally managed lands throughout the western states. In the Northwest Forest Plan area, the review concluded that the reserve network of the Northwest Forest Plan was currently providing sufficient habitat for the goshawk and would continue to meet this species needs in the future (63 FR 35183).

## **Environmental Consequences and Comparison of Alternatives**

The three action alternatives considered in this SEIS would have similar effects on late-successional birds (except the four Protection Buffer species) across the broad landscape of the Northwest Forest Plan area. The primary effect of Alternatives 1, 2, and 3 on late-successional bird species, in general, would result from removing protection for 63 Survey and Manage species and reduction in the area where the Survey and Manage Standards and Guidelines apply for 9 species (see Chapter 2). This difference between the action alternatives and the No-Action Alternative would be the loss of protection for approximately 24,800 acres of late-successional forest across the Northwest Forest Plan area. However, the presence of other Survey and Manage species at the same locations could result in continued protection for some of these locations.

The acreage of protected habitat for Survey and Manage species, though important for these individual species, occurs as scattered, relatively small patches which provide little overall contribution to the maintenance of most of the wide-ranging bird species. While these areas may provide some benefits to bird species which successfully use smaller patches of late-successional forest and would provide some structure and habitat complexity to the harvested area through the next stand rotation, any effects are very small when compared to the contribution of Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves.

Due to the potential for changes in the Survey and Manage species, and changes in the number of acres affected, the adaptive management component of the action alternatives creates uncertainty as to its effect on other land management programs and environmental conditions. The No-Action Alternative is somewhat static in the number of species it would retain under Survey and Manage, though it is still possible that species could be removed. Even so, future surveys for the species covered under the No-Action Alternative would result in new locations and additional acres identified for species management. Alternatives 1, 2, and 3 allow both deletions and additions to Survey and Manage, which exacerbates the uncertainty in the acres affected. With any of these

alternatives, the fluctuating list of species, the fluctuation in acreage of known sites, and the potential location of new species sites, adds uncertainty to the estimate of future effects of the alternatives. Nevertheless, because of the inconsequential amount of habitat for late-successional birds provided by the Survey and Manage and Protection Buffer Standards and Guidelines, there is sufficient information on which to base a reasonable analysis and conclusion.

None of the alternatives in this SEIS would affect the original basis for most of the assessments of the effects to birds or the conclusions in the Northwest Forest Plan Final SEIS. Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves would continue to be managed for late-successional forest in the Northwest Forest Plan area, and the standards and guidelines for green trees, snags, and coarse woody debris would continue to benefit these bird species by providing nesting, roosting, and foraging habitat. Therefore, none of the alternatives in this SEIS would affect the conclusions made in the Northwest Forest Plan Final SEIS that these late-successional bird species will be adequately provided for under the Northwest Forest Plan. Late-successional forest associated bird species are generally stable and widespread throughout the Northwest Forest Plan area, and none of the alternatives considered here would substantially alter those distribution patterns or result in populations that are not stable within the planning area.

## **Great Gray Owl**

### **Background and Affected Environment**

Since the Northwest Forest Plan Record of Decision, Survey Protocols for the great gray owl have been implemented, the range of known nesting and occurrence of great gray owls has been expanded, and the state of knowledge of the great gray owl has been reassessed.

An auditory Survey Protocol for great gray owls was issued in May 1995 and amended in June 1997 in response to recommendations from scientists to improve the efficiency of the protocol. Recent information indicates that auditory protocols may not be a reliable method of detecting great gray owls. For example, surveys of 80,000 acres of potential nesting habitat for great gray owls in the vicinity of past sightings have not resulted in new detections. However, given the lack of an alternative methodology to locate these birds, the Survey Protocol remains the best available approach for finding and protecting sites where the species is believed to be located.

There has been an increase in the known range of the great gray owl since the Northwest Forest Plan Final SEIS. At the time of the Northwest Forest Plan Final SEIS analysis, the great gray owl was documented as nesting in an area along the central Cascade mountains of Oregon and in a small area southwest of Medford, Oregon. Published data (Hayward et al. 1994), and the results of surveys indicate the species range is likely much larger. Great gray owls have been documented over much of the Cascade Range in Oregon and Washington, though nesting has not been confirmed in some of these new areas. However, based on the locations and habitat, it is likely that these owls are nesting, and the Northwest Forest Plan Standards and Guidelines requirement to survey for and protect the nests applies to this broader area. In addition to increasing the geographic area of known and expected great gray owl nesting, recent information indicates that the owl uses elevations below the 3,000-foot level described in protocols (Huff et al. 1996 and USDA, USDI Species Review Panel 1999b).

Through the 1999 field season, federal agencies have located approximately 72 great gray owl sites which are currently being managed under the Northwest Forest Plan. Many of these sites were known at the time of the development of the Northwest Forest Plan and most received some form of protection under existing land and resource management plans. The Northwest Forest Plan provides additional protection for sites documented prior to 1994. As of 1999, approximately 6,700 acres are managed to protect known great gray owl sites. The acreage allocated at each site varies, depending on local habitat conditions and whether the site contains a known nest.

The Agencies estimate that approximately 500,000 acres of potential nesting habitat have been surveyed for great gray owls. Approximately 1 million acres of forest which may be great gray owl habitat have not been surveyed. An estimate of the current great gray owl population in the Northwest Forest Plan area is about 135 sites, but its distribution remains in question. The currently known sites are not evenly distributed across the Northwest Forest Plan area.

The great gray owl is moderately widespread throughout the Cascades Range in the Northwest Forest Plan area, but the lack of documentation of nesting pairs in large portions of their range indicates that the population distribution may be limited in some areas, or that owls are not being detected with the current Survey Protocol. The current population size is considered moderate to low. Based on its known distribution, the great gray owl is presumed to be moderately widespread in its geographic range within the Northwest Forest Plan area. Within this broader range, the species occurs within a limited to somewhat spotty distribution pattern, mostly above 3,000 feet elevation (but exceptions exist), and generally in the vicinity of meadows or other large openings, especially for nesting and foraging habitat. The species mobility provides for a distribution pattern with limited to potentially multiple connectivity among nesting sites.

### **Environmental Consequences and Comparison of Alternatives**

The three action alternatives move the great gray owl from Protection Buffer Standards and Guidelines to Survey and Manage Standards and Guidelines. The management requirements and resulting environmental consequences to the great gray owl and its habitat would be different among the alternatives.

The No-Action Alternative would require the management of 0.25-mile protection zones around all known great gray owl nests, and would require pre-disturbance surveys of potential great gray owl habitat. This alternative also includes a 300-foot, no-harvest buffer around meadows and natural openings as a means of protecting foraging habitat for the species.

Alternative 1 would protect all current and future great gray owl sites until criteria for identifying high-priority sites are included in Management Recommendations. High-priority sites are those sites that are considered necessary to maintain the species moderately widespread within the species' reference distribution in the Northwest Forest Plan area. Pre-disturbance and strategic surveys would be required. The 300-foot, no-harvest buffer around meadows and natural openings would remain in effect until or unless it is modified in the Management Recommendations.

Alternative 2 would limit the protection of known sites to those which were documented as of September 30, 1999 (approximately 72 great gray owl sites). Strategic surveys would be conducted within 5 years throughout the species' suspected range in the Northwest Forest Plan area. Based on the strategic survey information, the great gray owl would be removed from Survey and Manage and either assigned to the Agencies' special status species programs or removed from special management consideration. The 300-foot, no-harvest buffer around meadows and natural openings would remain in effect for 5 years unless the species is included in the Agencies' special status species programs, and known site management is deemed necessary to maintain the species within the planning area.

Alternative 3 would initially protect all current and future known sites until high-priority sites could be determined. Strategic surveys would be conducted for the species to determine important habitat and the ability of reserves to provide for stable populations. The 300-foot no-harvest buffer around meadows and natural openings would remain in effect unless it is replaced or removed from the Management Recommendations.

In the No-Action Alternative, the acreage set aside to protect nests and foraging habitat becomes a Late-Successional Reserve, with associated standards and guidelines. Applying the Late-Successional Reserve Standards and Guidelines to management of meadows as foraging habitat for great gray owls could result in management contrary to maintaining foraging habitat. The

Late-Successional Reserve Standards and Guidelines are designed to encourage development of late-successional forest conditions. This direction potentially conflicts with the need to discourage the encroachment of conifers into meadow habitat and to provide hunting perches and nesting snags near meadows. In this respect, the No-Action Alternative may be slightly detrimental to maintenance of foraging habitat of the great gray owl.

All three action alternatives would manage habitat identified for continued use and occupancy by great gray owls. Management Recommendations would be prepared that describe the use of prescribed fire or other methods to maintain meadow foraging habitat, and would delineate the management area for great gray owls using current knowledge of the species home range size and habitat needs.

The No-Action Alternative does not provide for strategic surveys, but instead relies on the approach of managing individual sites as they are located through pre-disturbance surveys. This approach reduces the likelihood that information would be gathered on great gray owl populations inside reserves since habitat-disturbing activities are generally infrequent in those land allocations and will become even less so as forests reach the age limit for most activities (80 years in most Late-Successional Reserves). The information base for great gray owl management would continue to be limited in the reserve land allocations, making results less certain. All three action alternatives provide for strategic surveys which would gather the information needed to manage great gray owl known sites. Therefore, under the action alternatives, the information on which to base management decisions for the great gray owl would likely include a more representative distribution within all land allocations, and ultimately provide data to improve those management decisions.

The No-Action Alternative does not describe a specific adaptive management strategy to be applied to the great gray owl Protection Buffer Standard and Guideline. Instead, it relies on general discussions of adaptive management, which provide unclear direction. All three action alternatives include specific adaptive management language for the great gray owl, and would provide a more structured process for the Agencies to address issues specific to this species and its effective management.

The No-Action Alternative may be slightly detrimental to maintenance of the great gray owl because 300-foot buffers around meadows and natural openings may conflict with the need to reduce the encroachment of conifers into meadow habitat, and provide hunting perches and nesting snags near meadows. All three action alternatives would benefit the great gray owl by allowing for meadows and openings to be managed for continued use and occupancy by great gray owls, including the allowance of prescribed fire or other methods to maintain meadows consistent with natural ecosystem processes and direction in the species' Management Recommendations. Management of the great gray owl under the action alternatives would maintain habitat to support this species in stable populations. While there is some uncertainty due to the potential for pre-disturbance surveys to not detect the species at nest sites, the No-Action Alternative would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

Alternatives 1 and 3 are similar in their effects on this species. The objective of the strategic surveys is to find the most important habitat for the species and determine the ability of reserves to provide for species stability. Knowledge of the status of great gray owl populations and habitat conditions within the reserve land allocations would allow a better assessment of the importance of Matrix in maintaining stable, moderately widespread populations. Determining important habitat for the species will require population demographic information from strategic surveys and other information gathering efforts sufficient for an understanding of site occupancy and population stability. In areas where there are limited Late-Successional Reserves and limited federally managed lands, knowledge of the status of Matrix sites is important to understanding the risks to the great gray owl.

As in Alternative 1, Alternative 3 shifts from managing all known sites to identifying and managing high-priority sites. Until high-priority sites are identified, all current and future known sites would be managed to maintain the species. High-priority sites identified for management through Management Recommendations should include all current and future sites needed to maintain the species, stable and moderately widespread, within its reference distribution. This would include protection of sites necessary to maintain stable, moderately widespread populations of the species in the Northwest Forest Plan area. Once high-priority sites, or methods for determining which future sites are high priority, are developed, sites not meeting these standards could be lost through management activities. While there is some uncertainty due to the potential for pre-disturbance surveys to not detect the species at nest sites, Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

Under Alternative 2, sites discovered after September 30, 1999, would not require management. This could result in inadvertent loss of sites from management activities; some are likely to be important for local to regional species distribution and stability. There is no requirement to maintain sites that are identified during strategic surveys or by other means over the 5-year interval. The extent or magnitude of this risk to the species has a moderate level of uncertainty because of currently incomplete information and unavailable projections of rates of disturbances within this species' range.

After 5 years, the long-term management strategy of this species is less certain under Alternative 2 than the other action alternatives. It is removed from the Survey and Manage Standards and Guidelines, and it would be determined, based on the existing knowledge at that time, whether it would be assigned to the Agencies' special status species programs or removed from special management consideration. Interim guidance requires that known sites (as of September 30, 1999) be managed until such a determination is made. Alternative 2 creates uncertainty in how the species would be managed following the 5-year interval. Given our limited knowledge of great gray owl population dynamics and ecology, the 5-year timeline may not be sufficient for completion of the studies necessary to make an informed recommendation as to the species future disposition. An understanding of population trend, longevity, demographics, and population densities specific to the status of these populations, requires the collection of data over several generations of owls (more than 5 years). The other action alternatives do not have this time restriction. While there is a high level of uncertainty due to limited timeframes for strategic surveys, and no requirements to manage sites found after September 30, 1999, Alternative 2 would provide sufficient habitat (including known sites) to allow species to stabilize in a pattern similar to its reference distribution.

Maintaining great gray owls requires providing habitat within the planning area that will support the species in stable populations in a distribution pattern similar to its reference distribution. Alternatives 1 and 3 provide a better combination of pre-disturbance surveys, strategic surveys, and options for Management Recommendations to provide for these conditions. Alternative 2 results in a high level of uncertainty that the species will remain stable and moderately widespread in the Northwest Forest Plan area, and it creates uncertainty in how the species would be managed following the 5-year survey interval. The No-Action Alternative results in a moderate level of uncertainty by not providing for strategic surveys, resulting in a lack of information that would improve our ability to develop effective Survey Protocols and long-term Management Recommendations.

In conclusion, Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the great gray owl to stabilize in a pattern similar to its reference distribution. While there is a moderate level of uncertainty due to the lack of strategic surveys and existing management direction that may promote encroachment of forested vegetation in preferred forage habitat (i.e. forest edge meadows), the No-Action Alternative would provide sufficient habitat (including known sites) to allow the great gray owl to stabilize in a pattern similar to its reference distribution. While there is a high level of uncertainty due to (1) the lack of a requirement for known site management for sites found after September 30, 1999, and (2) the requirement to

complete strategic surveys within 5 years, Alternative 2 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution.

## **Black-backed Woodpecker, White-headed Woodpecker, Pygmy Nuthatch, and Flammulated Owl**

### **Background and Affected Environment**

The Northwest Forest Plan Final SEIS concluded that there was a very high likelihood that Alternative 9 (the selected alternative) would provide habitat sufficient to allow populations of the white-headed woodpecker, pygmy nuthatch, and flammulated owl to stabilize well distributed within their range in the Northwest Forest Plan area. For the black-backed woodpecker, Alternative 9 was determined to provide a high likelihood that habitat would be sufficient to support stable, well-distributed populations across its range, after additional measures to protect snags were incorporated into the alternative. The Protection Buffer Standards and Guidelines focus on retaining large snags, which, along with the provision of Congressionally Withdrawn Areas, Late-Successional Reserves, Riparian Reserves, watershed analysis, and the retention of green trees, snags, and coarse woody debris in areas of timber harvest, were the basis for the Northwest Forest Plan Final SEIS conclusions for these four species.

These Protection Buffer species were not evaluated through the Species Review Process because their standards and guidelines are specific to primarily one component of the forest environment: snags.

These four species all occur on the periphery of the range of the northern spotted owl on the east slope of the Cascade Range in Washington and Oregon. The white-headed woodpecker and the flammulated owl also occur in the Klamath Physiographic Provinces in northwestern California and southwestern Oregon. Their current range (and inferred historic range) is moderately widespread within the Northwest Forest Plan area; their range occurs in somewhat limited locations in drier montane and eastside forest habitats with snag components. These species are relatively mobile, and are assumed to have limited to multiple avenues of connectivity among forest stands that support sites or clusters of sites.

These four species were addressed as part of the Columbia Basin Science Assessment work, which includes the eastern slope of the Cascade Range where this standard and guideline primarily applies. The Source Habitat Analysis (Wisdom et al. 1999) placed the white-headed woodpecker and the pygmy nuthatch in Family 1 and the flammulated owl and the black-backed woodpecker in Family 2, based on similar habitat needs. Family 1 was generally characterized as requiring large diameter (>20-inch (53 cm) dbh) snags with cavities, that are found in montane forests which are usually maintained by frequent, low-intensity fires. Many species in Family 2 are dependent on snags in multi-layered and single-layered montane forests. The analysis concluded that the habitat for both of these families has declined throughout the Columbia Basin and, in some areas, the species populations have also declined. The sensitivity of these species to the presence of snags, particularly large snags which may be affected by management activities, supports the need for consideration of these four species in the Northwest Forest Plan.

### **Environmental Consequences and Comparison of Alternatives**

Under the No-Action Alternative, these four bird species are managed under the Protection Buffer Standards and Guidelines as applied to Riparian Reserves and Matrix lands. The three action alternatives move these species to a separate standard and guideline that applies to all land allocations, which would broaden the area where management attention is required for these species. The action alternatives also include three changes to the management requirements for these species. The new standard and guideline would: (1) allow removal of snags deemed to be in excess of the number needed to provide for 100 percent of the potential population levels of these



four species; (2) include a specific adaptive management clause that encourages timely adoption of new information; and, (3) provide clarification to management of even-aged, young stands with regards to these species. The new standard and guideline further clarifies the need to incorporate new information on species' needs when designing management direction for attaining 100 percent of population levels.

The general effect of applying this standard and guideline to all land allocations in the action alternatives as compared to the No-Action Alternative would be minimal. Reserved land allocations (Late-Successional Reserves, Riparian Reserves, Congressionally Withdrawn Areas, and Administratively Withdrawn Areas) should, for the most part, already be managed for maximum potential for snag-dependent species. Therefore, the addition of management direction to the reserve land allocations in this standard and guideline is anticipated to have little impact.

The No-Action Alternative recommends retention of all snags greater than 20 inches dbh. The action alternatives would allow removal of some large snags that are documented to be in excess of these species needs. However, application and incorporation of new information about species' snag needs into project design should minimize any adverse effects to these species from loss of these essential habitat components.

The action alternatives provide for the adoption of new information through development or revision of Management Recommendations. This should result in a slight improvement of habitat management for these species. The development or revision of Management Recommendations would allow new information to be more readily incorporated into management for the species. This clarification would allow adoption of more up-to-date species and habitat information that differs from the standards (Neitro et al. 1985) applied in the original Protection Buffer Standards and Guidelines.

The action alternatives include a clarification that young, even-aged stands pose a unique situation with regards to managing snags for these species, which should result in a slight improvement of habitat management. Thinning of even-aged, young stands would be allowed and would provide greater opportunity for managing dense stands where snag levels are low. This would provide long-term benefits to forest structure and habitat for these four species.

The action alternatives allow for loss of some large snags if they are in excess of what is needed to support 100 percent of the potential populations for these four species. Because the models for determining the number of snags necessary to support the populations are based on regional information and there is natural variability across the range of these species, this may have a slight negative effect on these species in some areas by reducing local nesting or foraging opportunities. However, this effect is likely counteracted by the ability to make timely changes based on new information, and the slight improvement in the long-term habitat conditions for these species as the result of thinning even-aged, young stands. Therefore, none of the alternatives in this SEIS would affect the conclusions of the Northwest Forest Plan Final SEIS that habitat for these four cavity nesting birds will be adequate to support stable populations distributed through the species' historic range in the Northwest Forest Plan area.

The action alternatives are expected to provide better habitat conditions for these species than the No-Action Alternative, due to their ability to incorporate updated information into Management Recommendations, and provide for more effective retention of critical habitat components, including snags. An additional benefit to these species would be the ability to anticipate snag needs for these species when modeling and designing restoration activities (such as thinning to accelerate tree growth) in reserve allocations. All alternatives would provide sufficient habitat (including known sites) to allow these species to stabilize in a pattern not substantially altered from their reference distributions within the planning area. However, incorporating new information essential to maintaining habitat would be more difficult under the No-Action Alternative because it does not include a specific process for adaptive management.

# **Late-Successional Mammals**

## **General Discussion**

### **Background and Affected Environment**

The Northwest Forest Plan Final SEIS analysis of alternatives listed the land management factors that are most important for the 14 mammal species associated with late-successional forests. These factors include dead and dying trees and the down woody material they produce; live, old-growth trees; presence of large areas of late-successional forest in Late-Successional Reserves; and protection of riparian zones (USDA, USDI 1994a, pp. 3&4-182 through 185). After 6 years of implementing the Northwest Forest Plan, there has been a slight improvement in conditions for the 14 mammal species over the effects originally analyzed in the Northwest Forest Plan Final SEIS, in part, as a result of lower than anticipated timber harvest levels in the Matrix and Adaptive Management Areas. The primary long-term benefits of the Northwest Forest Plan to these species are the retention of green trees, snags, and coarse woody debris in harvest units, and standards and guidelines for Late-Successional Reserves and Riparian Reserves (USDA, USDI 1994b).

Management of the Riparian Reserves, Congressionally Withdrawn Areas, and Late-Successional Reserves has occurred as anticipated in the Northwest Forest Plan Final SEIS. The most common activities in the Late-Successional Reserves are silvicultural thinning of stands (not currently of appropriate age and structural characteristics to be classified as late-successional) to accelerate the development of late-successional forest structural and functional conditions, and for fire risk management (fuels reduction) in the drier forest types. Similar thinning activities have occurred in Riparian Reserves where consistent with Aquatic Conservation Strategy objectives.

The primary effect of the Survey and Manage Standards and Guidelines on late-successional forest associated mammal habitat has resulted from protection of small areas of late-successional habitat in the Matrix and Adaptive Management Areas as a result of the management of known sites of Survey and Manage species. The retention of late-successional habitat through the Survey and Manage species known sites was not originally judged by the FEMAT panelists as substantially contributing to the long-term management of late-successional forest associated mammal species, exceptions being the red tree vole and bats, discussed below, and the Canada lynx, discussed in the Threatened and Endangered Species section. The result of Survey and Manage implementation has been a relatively small beneficial effect to late-successional mammals, considering the scale of the Northwest Forest Plan. Beneficial effects for the late-successional mammals from other components of the Northwest Forest Plan, including Late-Successional Reserves, Riparian Reserves, and green tree, snag, and coarse woody debris retention, far outweigh the limited effect of the small scattered patches of late-successional forest provided by the Survey and Manage Standards and Guidelines.

### **Environmental Consequences and Comparison of Alternatives**

The three action alternatives would have similar effects on late-successional mammals across the broad landscape of the Northwest Forest Plan area because the components that most affect these species remain substantially the same. The primary difference in current effects to late-successional mammals between the No-Action Alternative and the three action alternatives, in general, would be from removing protection for 63 Survey and Manage and Protection Buffer Species and the reduced area where the Survey and Manage Standards and Guidelines apply for 9 species under the action alternatives. This difference of effects would result from the loss of management protection for approximately 24,800 acres of late-successional habitat in Matrix and Adaptive Management Area land allocations across the Northwest Forest Plan area. However, the presence of other Survey and Manage species that would still require management at the same site could result in continued protection for some of these locations. Under Alternative 2, approximately 422,000 acres of late-successional forest could become subject to habitat-disturbing

management activities after 5 years when uncommon species would be removed from Survey and Manage Standards and Guidelines, if not needed for management of these species under the Agencies' special status species programs.

Habitat managed as known sites of Survey and Manage species, though important for the individual species, occurs as scattered, relatively small patches which provide little contribution to the maintenance of most wide-ranging mammals, such as fisher, pine marten, and wolverine. While these areas may provide some structure and habitat complexity to the harvested area through the next stand rotation, any effects are small when compared to the contribution of Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves, and Matrix Standards and Guidelines, such as green tree retention.

The small patches of late-successional habitat retained for Survey and Manage species could be large enough to provide habitat for individuals of the smaller mammal species assessed in the Northwest Forest Plan Final SEIS. At a local level, these patches would further improve the potential distribution of small mammals by providing additional, though scattered, habitat. However, Alternative 9 of the Northwest Forest Plan Final SEIS (the selected alternative) was generally considered to provide sufficient habitat distributed across the range for the late-successional forest associated mammals without any specific level of anticipated contribution from the Survey and Manage Standards and Guidelines.

None of the alternatives would substantially change the original basis for the mammal assessments by FEMAT or the Northwest Forest Plan Final SEIS because of: (1) the limited acreage and unpredictable distribution of protected late-successional forest under the Survey and Manage Standards and Guidelines and (2) the conclusions in the Northwest Forest Plan Final SEIS that late-successional mammal species were adequately protected without any anticipated contribution from the Survey and Manage Standards and Guidelines. Under all four alternatives, Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves would continue to be managed to protect and restore late-successional forest throughout the Northwest Forest Plan area. Standards and guidelines for green trees, snags, and coarse woody debris in the Matrix will continue to provide long-term benefits to these species. The result under all the alternatives would be well-distributed, late-successional forest to support all of the mammal species assessed in stable populations distributed within their historic range in the Northwest Forest Plan area.

Since the No-Action Alternative would not remove species from Survey and Manage at this time, it is projected to manage approximately 483,000 acres of known sites for all Survey and Manage species, much of it as late-successional forest. Alternative 1 is projected to manage approximately 81,000 acres in known sites. Alternative 2 may provide slightly less late-successional habitat after 5 years (approximately 61,000 acres) due to removing uncommon species. Alternative 3 is projected to manage about 570,000 acres of additional habitat, much of it late-successional, as a result of applying equivalent-effort surveys and 250-meter buffers around species locations. (A more detailed description of the assumptions and results of this analysis is provided in the Timber Harvest section of this chapter.)

Currently, no data are available that might indicate how many of these acres are currently or potentially occupied by the 14 mammal species associated with late-successional forests. Based on this analysis, Alternative 3 and the No-Action Alternative would manage somewhat more acres of Matrix and Adaptive Management Area in a condition better suited to late-successional forest associated mammals, where they occur, than would Alternatives 1 and 2. However, the Northwest Forest Plan Final SEIS concluded that late-successional forest associated mammals were already adequately provided for by other elements of the Northwest Forest Plan without any anticipated contribution from the Survey and Manage Standards and Guidelines. Therefore, differences in acreage of managed known sites between alternatives do not represent "gains" or "losses" of habitat essential to Northwest Forest Plan Final SEIS conclusions of species viability.

Due to the potential for changes in Survey and Manage and resulting changes in the number of acres affected, the adaptive management components of Survey and Manage creates uncertainty as to their effect on other land management programs and environmental conditions. The No-Action Alternative is somewhat static in the number of species it would retain on Survey and Manage, though it is still possible that species could be removed following future analysis. Even so, future surveys for the species covered under the No-Action Alternative would result in new site locations and additional acres identified for the species management. Alternatives 1, 2, and 3 allow both deletions and additions of species to the Survey and Manage Standards and Guidelines, which exacerbates the uncertainty in the acres affected. With any of these alternatives, the fluctuating list of species affected, the fluctuation in acreage of known sites, and the potential location of new species sites, adds uncertainty to the estimate of future effects of the alternatives. Nevertheless, because of the inconsequential amount of habitat for late-successional mammals provided by the Survey and Manage and Protection Buffer Standards and Guidelines in comparison to the reserve allocations, there is sufficient information on which to base a reasoned analysis and conclusion.

Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves would continue to be managed for late-successional forest in the Northwest Forest Plan area and standards and guidelines for green trees, snags, and coarse woody debris would continue to benefit these 14 mammal species. Therefore, none of the alternatives in this SEIS would substantially affect the conclusions of the Northwest Forest Plan Final SEIS. Late-successional forest associated mammals, as a group, are relatively widely distributed within the planning area, and are likely to remain stable and widely distributed in a pattern similar to their historic distributions under all alternatives. Although the alternatives provide somewhat different total amounts of late-successional forest over time, all alternatives are expected to provide for stable populations of late-successional forest associated mammals across their historic ranges in the Northwest Forest Plan area for 100 years.

## **Bats**

### **Background and Affected Environment**

Bats received separate attention in the Northwest Forest Plan Final SEIS because of their specialized habitat requirements and life history traits, including their use of human structures (buildings, bridges, mines, etc.), their migratory and winter roosting behavior, and communal habits. The Northwest Forest Plan Final SEIS analysis listed the land management factors which are most important for bats as: (1) the presence of large areas of late-successional forest in the Late-Successional Reserves throughout the Northwest Forest Plan area; (2) protection of riparian zones; and, (3) retention of live, dead, and dying old-growth trees (USDA, USDI 1994a, pp. 3&4-186 through 190).

Bats, as a group, are widely distributed across the planning area, and use a variety of habitats. All species being considered here are associated with late-successional forest, and also occur widely outside of the planning area. Individual species, while still relatively widespread, may have a more limited local distribution within the planning area, but still occur over the majority of the range of the northern spotted owl. Bats use of a variety of structures for hibernacula and maternity roosts, and their vulnerability to human disturbance led to the addition of specific standard and guideline language to address this concern (USDA, USDI 1994b, p. C-43). Alternative 9 (the selected alternative) was generally considered to provide sufficient habitat distributed across their range for the bat species analyzed in the Northwest Forest Plan Final SEIS, based on the land management factors described above and including the protection of caves, mines, and other structures.

After 6 years of implementing the Northwest Forest Plan, there has been a slight improvement in expected conditions for the 11 bat species over the effects originally analyzed in the Northwest Forest Plan Final SEIS. This is a result of lower than anticipated timber harvest levels in the Matrix and Adaptive Management Areas. A long-term benefit of the Northwest Forest Plan to these species accrues from the retention of clumps of green trees and snags in harvest units, and

management of Late-Successional Reserves and Riparian Reserves as required in the Northwest Forest Plan Record of Decision (USDA, USDI 1994b). Management of the Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves provide habitat at a coarse, regional scale for forest-dwelling bats in the Northwest Forest Plan area. The most common activities in the Late-Successional Reserves are silvicultural thinning of stands (not currently of appropriate age and structural characteristics to be classified as late-successional) to accelerate the development of late-successional forest structural and functional conditions, and for risk management (fuels reduction) in the drier forest types. Similar thinning activities have occurred in Riparian Reserves where consistent with Aquatic Conservation Strategy objectives.

Some components of the current bat standard and guideline may be detrimental to these species. The standard and guideline requires searches for bat roosts and identification of bats by species. Searches for, and capture of, bats necessary to identify the species may be harmful to the bats by causing them to expend energy at times when their energy reserves are low (such as during hibernation or maternal periods) or may cause abandonment of young. Identifying bat species is not always necessary to the design of appropriate management of a bat site. Site management is often the same, regardless of the species of bat present at the site.

The primary beneficial effects of implementation of the Survey and Manage Standards and Guidelines on bat habitat has resulted from protection of small areas of late-successional forest in the Matrix and Adaptive Management Areas as a result of the management of known sites. The late-successional forest retention that has resulted from Survey and Manage has occurred in land allocations which were not originally judged by FEMAT panelists as contributing to the long-term management for the bats. The result of Survey and Manage implementation has been a relatively minimal beneficial effect to the bats. Beneficial effects from other components of the Northwest Forest Plan, including Late-Successional Reserves, Riparian Reserves, and green tree, snag, and coarse woody debris retention, far outweigh the limited effect of the small scattered patches of late-successional forest provided by the Survey and Manage Standards and Guidelines. Because of the small size and scattered nature of these protected areas, the Survey and Manage Standards and Guidelines do not provide an essential habitat contribution to the maintenance of well-distributed, late-successional forest at the landscape scale for these bat species.

In addition to habitat protection provided through implementation of the standards and guidelines for land allocations and Survey and Manage species, bats have also benefitted from protection of bridges, caves, mines, and other structures as a result of implementation of the Provide Additional Protection for Bats Standard and Guideline. Although adverse impacts to bats may have occurred from conducting surveys to identify species, sites found using these surveys have received protection as prescribed under this standard and guideline.

### **Environmental Consequences and Comparison of Alternatives**

As described in the general discussion of late-successional forest mammals (above), bats would receive their primary protection through management of Congressionally Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves, and through standards and guidelines applied to Matrix and Adaptive Management Area land allocations. Bats may also benefit from the retention of small patches of late-successional forests under all alternatives. The four alternatives vary in their management of Survey and Manage species known sites, and the projected number of acres of late-successional forest that would be available for timber harvest. In addition, the action alternatives would remove 72 Survey and Manage species in all or part of their ranges, and managed known sites for these species would be available for potential timber harvest, accounting in part for the difference in projected acres allocated to managed known sites in the future. Conclusions regarding the overall availability of late-successional forest to bats would be similar to that for mammals in general.

The alternatives vary in the amount of late-successional forest that is projected to be available across the Northwest Forest Plan area in the future. Alternative 9 of the Northwest Forest Plan Final SEIS (the selected alternative) was generally considered to provide sufficient habitat well

distributed across the range for the bat species without any anticipated contribution from the Survey and Manage Standards and Guidelines. Since implementation of any of the alternatives in this SEIS would result in additional availability of late-successional forest to bats, no alternative would substantially affect the conclusions of the Northwest Forest Plan Final SEIS that these late-successional species will be adequately provided for under the Northwest Forest Plan.

The three action alternatives incorporate the same management direction specific to bats and would have an identical effect on bats across the broad landscape of the Northwest Forest Plan area. Under the action alternatives, the standard and guideline for bats (Provide Additional Protection for Caves, Mines, and Abandoned Wooden Bridges and Buildings that are Used as Roost Sites for Bats) modifies the survey and identification requirements to avoid adverse effects on bats. In contrast, the No-Action Alternative requires surveys for bats during critical roosting and maternal periods. Under the action alternatives, surveys would be conducted to locate any bat species that might be at a particular site, rather than be specific to those species targeted in the Northwest Forest Plan. Individual species identification is not required to presume occupancy regardless of species present, until identification methods that do not harm the species are developed and implemented. Surveys conducted under the No-Action Alternative would still be required to identify bats by species and could result in harmful disturbance to bats. This adverse impact is not anticipated to occur under the action alternatives.

Interim requirements to prohibit timber harvest within 250 feet of these sites, and develop management direction and site protection plans, would be identical across all alternatives. The action alternatives may result in protection to some additional bat sites over those protected under the No-Action Alternative, due to the provision to protect all bat sites regardless of species present. This protection of some sites may be temporary, if future survey methods are developed that achieve a high degree of certainty for target species identification with a low level of impacts. Finally, under modifications to this standard and guideline in the action alternatives, other measures may be addressed through Management Recommendations when needed to ensure bat species remain stable and distributed throughout their historic range in the Northwest Forest Plan area following appropriate NEPA analysis and disclosure.

All alternatives are consistent with the conclusions of the Northwest Forest Plan Final SEIS, that the selected alternative (Alternative 9) provides for sufficient habitat well distributed across the range for bat species. The result under all the alternatives being considered here would be late-successional forest distributed widespread in the planning area to support all of these bat species. The three action alternatives reduce or eliminate the previously unanticipated harmful effects of intrusive species-specific surveys required under the No-Action Alternative, and would be consistent with conclusions from the Northwest Forest Plan Final SEIS that bats would be stable and distributed in a pattern similar to their historic distribution. Bats would continue to be widespread throughout the Northwest Forest Plan area.

## **Oregon Red Tree Vole (*Arborimus longicaudus*)**

### **Background and Affected Environment**

The Oregon red tree vole (referred to herein as the red tree vole) is the most arboreal (tree-dwelling) mammal in the Pacific Northwest (Carey 1996) and is endemic to moist coniferous forests of western Oregon and extreme northwestern California. Its distribution is limited within the Northwest Forest Plan area and it is limited throughout its range to coniferous forests. Red tree voles depend on conifer tree canopies for nesting sites, foraging, travel routes, escape cover, and moisture (Carey 1991). Douglas-fir needles provide the primary food and building materials for nests. The red tree vole is a locally important prey species for the threatened northern spotted owl. During a study conducted in the 1970's, red tree vole's contribution to prey varied in different portions of the range of the owl, from a low of 3.7 percent of the total prey items in the northern Cascades to a high of 49.1 percent for two owl pairs in the Douglas-fir/coast redwood zone along the southern Oregon Coast (Forsman et al. 1984). The mean contribution, across seven study areas, that red tree voles made to owl diet items was 15.1 percent of all prey items (Forsman

et al. 1984). Due to their small size, red tree voles provided 2 to 19 percent of the total diet biomass (Forsman et al. 1984). Red tree voles were rated as the most vulnerable of all arboreal rodents to local extirpations from habitat fragmentation or loss (Huff et al. 1992). The red tree vole's close association with old-growth, Douglas-fir forests (Carey 1989 and Ruggiero et al. 1991) suggests that major reductions in old-growth, Douglas-fir forests in the future would likely result in declines in red tree vole populations.

Assessments of red tree vole distribution are generally based on locations where museum specimens were collected in the past or where pre-project surveys have been conducted by BLM Districts and the National Forests. These surveys indirectly confirm the presence of red tree voles by identifying nests and attempting to determine if the nests are currently occupied. Surveys may find a mixture of currently occupied red tree vole nests and old nests in various stages of deterioration along with the nests of other arboreal rodents. To date, no study has estimated the size of any local red tree vole population or determined population trends within the species geographic range.

Since the implementation of the Northwest Forest Plan, the known and suspected range of the species has been expanded by approximately 3 million acres in southern Oregon and northern California. The red tree vole's geographic range includes approximately 16.3 million acres across all land ownerships; federally managed lands provide important habitat. More than 70 percent of the known sites and approximately 47 percent of the known and suspected range is on federally managed lands (USDA, USDI Species Review Panel 2000b). The expansion in the species' known and suspected geographic range was based on limited numbers of sites identified during the 1970's (Zentner 1977 and Forsman et al. 1984) combined with new sites identified by pre-project and research surveys conducted since 1994. There are scattered known sites within the area of expansion, but there have been insufficient surveys within the extended range to fully describe the species local distribution or possible habitat relationships in this region. Forest conditions within the expanded portion of the known and suspected range are generally drier than traditional habitat and habitat relations for the species within these dry forest conditions is poorly understood at this time.

The Interim Survey Protocol (in effect between November 1996 and July 1999) required surveys prior to ground-disturbing activities in fifth-field watersheds with more than 10 percent federal lands and where less than 40 percent of the federally managed land was in potential red tree vole habitats. Surveys were generally not conducted in areas exceeding these thresholds. Potential red tree vole habitats for these surveys were defined as forest (1) with approximately 60 percent or greater crown closure; (2) with conifers approximately 10 inches dbh or greater; and, (3) where these minimum conditions could be maintained through the end of fiscal year 2000. Since July 1999, pre-disturbance surveys have been conducted on all potential habitats within proposed project areas throughout the known and suspected range of the species.

Due to the Interim Survey Protocol, 10 of 12 National Forests and BLM Districts were not required to survey for red tree voles (USDA, USDI Species Review Panel 1999b). Pre-disturbance surveys efforts were not uniformly distributed across the geographic range. Many lower elevation forests of western Oregon and northern California, such as the Willamette Valley foothills and northern and southern Coast Range, had no survey effort. Pre-disturbance surveys are not a random sample of suitable habitat, but are designed to assure that red tree vole nests are not located in project areas. Projects, in general, were planned in habitat areas that had a lower probability of locating red tree vole nests.

More than 660 pre-disturbance surveys have been conducted by BLM Districts and National Forests in western Oregon in the last 6 years. These surveys covered more than 86,000 acres (USDA, USDI 1999a) and found 323 new locations containing confirmed red tree vole nests; of those locations, 114 (35 percent) had confirmed active nests (USDA, USDI Species Review Panel 2000b). The distribution of this survey effort was not uniform across the species geographic range, but concentrated on a few administrative units that fell below the 40 percent screen. For example, Medford District BLM conducted approximately 84 percent of all pre-disturbance

surveys and surveyed more than 44 percent of the total land area surveyed to date. They found 72 percent (234) of new locations; three watersheds within the Medford District BLM produced the majority of these sites. The Trail Creek watershed alone produced 14 percent (45) of new red tree vole locations. This concentration of survey effort and red tree vole detections within a limited portion of the species range confounds our ability to extrapolate across the species' geographic range or fully assess the species' status (USDA, USDI Species Review Panel 2000b).

The red tree vole has many life history characteristics that, given current information, cumulatively raise concerns for long-term persistence of local populations in portions of its geographic range (Carey 1989 and Maser et al. 1981). These life history characteristics include very small home ranges, low dispersal capability, a sensitivity to stand-level disturbances relative to many ground-dwelling rodents, and low reproductive potential relative to other microtines (rodent species in the subfamily Microtinae, which includes voles and lemmings). As characteristic of all microtine rodents, this is also a species that turns over its populations rapidly. That is, individuals show a short life span and a countering high reproductive rate compared to larger mammals. Thus, given a high turnover, populations in younger and older forests must be reproductively successful every year or the local populations will likely be extirpated.

Currently, it is not definitively known how red tree voles interact. There is indication (Johnson and George 1991) that genetic variation within and between populations, possibly due to small population size and inbreeding, may have long-range effects on persistence. However, the extent to which genetic variations within and among populations may affect management objectives is unknown. Many of the newly found sites seem to have few individuals, as estimated from nest numbers and, therefore, are dependent on dispersal and connectivity to provide mates.

Red tree voles are hard to locate, generally patchy in their distribution, and occur in small populations on the landscape (Carey 1991). Assessing the number of red tree voles at individual sites is a critical statistic used in the species assessment process. Pre-disturbance surveys are not designed to estimate population levels at sites. Rather, they are designed to confirm presence or absence at potential project areas. Without specific estimates of red tree vole abundance, the species assessment relied on the numbers of active nests as a substitute.

Since 1995, 323 stands were located that contained confirmed red tree vole nest trees. These surveys detected 1,399 red tree vole nest trees; 19.7 percent (276) were confirmed as being occupied (active nests) at the time of the survey. The remaining 80.3 percent (1,123) were old, inactive nests or current usage could not be determined. Six percent (19) of the new red tree vole sites consisted of only a single active nest and 6.5 percent (21) of new sites contained a single active nest with a number of old nests in the area. Eleven percent (37) of new sites had 2 to 5 active nests while only 11 sites (3.4 percent) had more than 5 active nest trees. The remaining 217 of 323 sites (68 percent) contained only inactive nests or nests of unconfirmed status. Sites comprised of only "unconfirmed activity status nests" contained from 1 to 36 nest trees; 43 percent (93) of these 217 sites contained only a single nest, while 40 percent (87) had 2 to 5 inactive nests or nests of unconfirmed usage (USDA, USDI Species Review Panel 2000b).

The low number of active nests reported at sites identified during pre-project surveys (USDA, USDI Species Review Panel 2000b), as well as the total number of confirmed nest trees detected at these sites, suggest low red tree vole densities, when compared to density levels believed to be needed to maintain normal species interactions. These low densities are also below levels normally detected for other microtine rodent species. These low densities suggest many newly identified sites may be too small to be sustainable and would have to rely on emigrants to maintain persistence at the site. At the present time, there is insufficient information available to determine if these low abundances are a result of natural conditions or represent conditions that are substantially altered from the historic state. Population stability is best ensured when the number of individuals in a population is large enough to ensure attainment of reproductive potential, normal interactions within the local population, and sufficient genetic variation to allow a species



to adapt. Low red tree vole densities, occurring at many sites, may indicate that these localized populations may not be stable because of low abundance. However, red tree vole populations have not been studied in sufficient detail to assess population trends.

The assessment of the historical (reference) distribution of the red tree vole was derived from knowledge of the distribution of currently known sites and understanding of the historic pattern and distribution of old-growth and older mixed-age forests within the species geographic range. This appraisal of the reference distribution incorporates limited understanding of the patterns of natural disturbance and attempts to account for the life history characteristic of the red tree vole. Where ecological information is lacking or poorly understood, the general understanding of the biology of other microtine rodents was carefully used as a guide. As acknowledged in the SAT report, the FEMAT report, and the Northwest Forest Plan Final SEIS, additional studies are needed to better understand the red tree vole's basic ecology. General assumptions used to assess the historic, current, and future distribution and stability of the red tree vole included:

- Populations are believed to be more widespread in the more mesic portions of their range, such as the central Coast Range and Cascades, but are progressively more limited and with less connectivity in portions of the range where mesic forests intergrade with xeric forests such as adjacent to the Rogue River Valley, the Klamath Mountains, and the drier Siskiyou Mountains.
- The primary habitat for the red tree vole is comprised primarily of forests classified as old-growth and older, mixed-age stands (Carey 1989 and Ruggiero et al. 1991). These stands are generally dominated by multistoried and single-storied conifer trees greater than 20 inches dbh. It is the mixed-age stands that has led to much of the debate over what is red tree vole habitat. Mixed-age stands defy a single description because they are not old growth and they are not young, even-aged stands. Mixed-age forests are common in some areas, like the Coast Range (USDA et al. 1993, p. II-2) and the dry forests of southern Oregon and northern California where extensive fires occurred in the 1800's.
- This species, as characteristic of most microtine rodents, turns over its populations rapidly. That is, individuals show a short life span and a relatively high reproductive rate (compared to larger mammals). Thus, given a high turnover, populations in all stand conditions must be reproductively successful every year or the local population will likely be extirpated.
- Red tree voles are believed to have limited dispersal (narrowly defined here as movements away from natal sites) capability. This dispersal ability is consistent with dispersal ability known from other microtines and mice species. The red tree vole's use of limb-to-limb travel routes to move through forest canopies may also limit or slow their movements. A combination of other factors, including physical limitations, behavior, and the expected survival characteristics to transient individuals, suggest red tree voles would move a few hundred feet or less if they leave their natal areas at all. Microtines in general have not evolved as long distance movers and it would be unrealistic to expect a red tree vole to successfully cross miles of non-habitat to re-colonize habitat patches. Long distance movements expose an individual to increased vulnerability of predation and increased risk of not finding a mate.
- The rodent "Resident Fitness Hypothesis" suggests "offspring should attempt to remain on or associated with the natal site, especially if resources are abundant" (Anderson 1989) because the natal area has proven adequate resources for survival and reproductive success. The proven resources at the natal area should be advantageous to the offspring.
- The scale of fragmentation induced by the pattern of federally managed and private land ownership can introduce habitat gaps from one square mile to tens of square miles. These can be isolating mechanisms for local populations. Based on the assumption that

little late-successional forest will remain on nonfederal lands over the long term, significant gaps and isolations of local populations will be imposed on the distribution of red tree vole populations on federally managed lands due to land ownership patterns alone. For example, in the southern Willamette Valley Margin, BLM manages many lands with a “Connectivity/Diversity Block Prescription” because of this area’s importance as a connective corridor between late-successional species in the Cascades and Coast Ranges. However, the current harvest patterns on nonfederal forest lands often removes trees from extensive areas around the federally managed parcels. Given the checkerboard or more fragmented ownership of federally managed land, there are limited pathways for red tree vole dispersal except possibly through section corner to section corner between federally managed parcels.

- The role of young forests in the population dynamics of red tree voles is not well understood. Red tree vole nests are found in some young stands; nest detections range from single nests located in a young stand adjacent to older habitat to multiple active nests in an apparently isolated young stand. No long-term studies or monitoring have occurred to provide temporal information with which to assess persistence of nest sites in younger stands or the rates of colonization. Colonization of a new site requires the chance arrival of multiple individuals at the site at approximately the same time, their successful reproduction, and the subsequent arrival of mates for the offspring. For all these chance events to occur, odds are placed against establishment of new sites. Sites in young stands that contain only a few nests may represent attempts of an emigrant to establish itself in unoccupied habitat. Other sites in young forests may represent residual populations that have been able to persist in spite of habitat disturbance. Emigrants may be able to occupy these less favorable habitats seasonally or intermittently.

Based on the distribution of known sites and our understanding of the historic pattern and distribution of old-growth and older mixed-age forests within the red tree vole’s range, combined with available information about timber harvest, fire, and other disturbances of the past several decades, it seems reasonable to assume that the historic distribution across all land ownerships combined was more extensive than today. The reference distribution recognizes the possibility of different patterns of red tree vole distribution between the portions of the range containing mesic forest conditions and the portion of the range containing xeric conditions. Between the mesic and xeric regions (1) the distribution pattern of known sites differs to some extent; (2) the distribution of likely habitat differs; (3) the biological distribution of sites and their connectivity appears to differ; and, (4) to some extent the distribution of federally managed land differs.

In general, the landscape that includes the more mesic forest conditions are believed to have historically contained more red tree vole habitat and that habitat is believed to have had a greater spatial extent than habitat patches found in the xeric forests of southern Oregon. Based on timber harvest during the late 1800’s and early 1900’s, much of the old mesic forest, especially lowland areas close to human population centers, were the first harvested (USDA et al. 1993, p. II-2). This harvest is thought to have included extensive tracts of potential red tree vole habitat in the northern third of the red tree vole’s range in Oregon and occurred on both federally managed and nonfederal lands.

This assessment of the historic and current distribution of potential red tree vole habitat suggests there are currently three relatively large distribution zones within the red tree vole’s geographic range where the red tree vole’s biological distribution patterns and the pattern of federally managed land may vary. These three zones can in general be described as the Mesic Forest Zone, Northern Mesic Forest Zone, and Xeric Forest Zone. Table 3&4-3 identifies the administrative units that generally occur within each of the distribution zones. The following text describes the location and particular habitat and distribution concerns that occur within each of these zones, including the three subzones in the Northern Mesic Forest Zone.

<b>Table 3&amp;4-3. List of administrative units within the red tree vole distribution zones. The distribution zones represent regions where the current biological distribution of red tree voles may differ.</b>	
<b>Mesic Forest Distribution Zone</b>	
Siuslaw NF (except Hebo RD)	Roseburg District BLM
Willamette NF (south of the Santiam River drainage)	Coos Bay District BLM
Umpqua NF	Medford District BLM, Glendale RA
Rogue River NF, Prospect RD	
Siskiyou NF (except Illinois Valley RD)	
Six Rivers NF (that portion within the known and suspected range)	
<b>Northern Mesic Forest Distribution Zone</b>	
Siuslaw NF, Hebo RD	Salem District BLM
Mt. Hood NF	Eugene District BLM
Willamette NF (north of and including the Santiam River drainage)	
<b>Xeric Forest Distribution Zone</b>	
Siskiyou NF, Illinois Valley RD	Medford District BLM, Butte Falls RA
Rogue River NF, Applegate RD	Medford District BLM, Grants Pass RA
Klamath NF (that portion within the known and suspected range)	Medford District BLM, Ashland RA
NF = National Forest, RD = Ranger District, RA = Resource Area	

### **Mesic Forest Distribution Zone**

The Mesic Forest Distribution Zone is the largest zone and contains the majority of the current primary red tree vole habitat within the known and suspected range of the species. The current distribution of red tree vole sites and potential habitat within the Mesic Forest Distribution Zone is a complex mixture of isolated known sites containing only one or a few active nests, to clusters of small sites within a small watershed, to a few blocks of potential habitat that should provide multiple sites with sufficient potential habitat likely to provide connectivity.

The many isolated sites containing only one to a few red tree vole nests currently being found are believed to represent either a small residual population of a once larger local population or an attempt of a dispersing individual to colonize a new site. If these sites remain isolated over time and not augmented by additional emigrants or increased reproduction, these small sites are not expected to persist.

The Mesic Forest Distribution Zone currently contains a substantial amount of older forest conditions that likely provide habitat for red tree voles. The species is assumed to be more widespread within this zone and the Northwest Forest Plan Standards and Guidelines will likely maintain habitat well distributed within this zone. There are pathways for connectivity between habitat in the more mesic portions of the central Coast Range and Cascades, but progressively more limited connectivity toward the southern edges of the distribution zone where mesic forests intergrade with xeric forests.

### Northern Mesic Forest Distribution Zone

The Northern Mesic Forests Distribution Zone extends from the southern end of the Willamette Valley northward along the Cascades and Oregon Coast Range. This zone differs from the Mesic Forest Zone by the current amount, juxtaposition of potential habitat, and other factors that may isolate current red tree voles or reduce the potential for connectivity between habitat blocks on federally managed lands. Based on the amount of old-growth and older mixed-age forests in this region, the current biological distribution of red tree vole sites and habitats within the zone are believed to be altered from the reference distribution. Therefore, analysis was conducted to determine if there were cumulative effects that may affect the future distribution of red tree voles on federally managed lands. The number of known sites in this zone is approximately 25 sites in the northern Coast Range portion and 22 sites in the Cascade portion. Based on current knowledge, the biological distribution of the species within this zone is primarily isolated sites or limited site clusters containing only a few nests (USDA Mt. Hood National Forest 1996; USDA, USDI Species Review Panel 2000b). The limited number of currently known sites and amount of habitat point to the potential for limited pathways for connectivity and low potential for gene flow between sites.

The Northern Mesic Forest Distribution Zone is comprised of three areas surrounding the Willamette Valley, each with specific concerns that the current distribution pattern may be altered from the reference distribution or concerns with habitat connectivity. The three areas include:

1. The Northern Coast Range Subzone: That portion of the Oregon Coast Range north of Highway 20 running between Newport and Corvallis and west of the non-forested Willamette Valley. Federally managed lands within this subzone include portions of the western half of the Salem District BLM and all of the Hebo Ranger District (Siuslaw NF). Concerns within this area are due to limited federally managed lands, geographic isolation of federally managed lands, and the regional distribution of the dusky red tree vole (*Arborimus longicaudus silvicola*), a recognized subspecies of the red tree vole.
2. The Northern Oregon Cascades Subzone: That portion of the northern Oregon Cascades north of and including the Santiam River drainage. Concerns within this subzone are due to the limited distribution and low numbers of known sites within an area that is believed to have historically contained red tree vole habitat.
3. The Southern Willamette Valley Margin Subzone (BLM Matrix Connectivity/Diversity Block land allocations): This subzone includes those federally managed lands south of and excluding the Santiam River drainage and all of the Eugene District BLM. Concerns within this subzone are due to decreased regional connectivity between red tree vole habitat, limited federally managed lands, and the checkerboard ownership pattern that may limit red tree vole dispersal.

Northern Coast Range Subzone: There is a high level of uncertainty relative to the current abundance and distribution of red tree vole populations in the Northern Coast Range of Oregon, due to geographic isolation and a federal management pattern that is limited in extent and surrounded by nonfederal ownerships. There are approximately 25 known sites, many from private lands in the Coast Range north of Corvallis. Natural connectivity between red tree vole populations in this region and the Cascade populations are blocked by the Willamette Valley. The general pattern of federally managed lands and private land ownership has a substantial influence on species distribution. If it is assumed that little late-successional forest will remain on nonfederal lands, then substantial gaps and isolations of local populations will result due to land ownership alone.

The state and private forests of the northern half of the Coast Range contain relatively few historic (pre-1994) known sites. Recent Coastal Oregon Productivity Enhancement Program small mammal studies (as reported by Dr. John Hayes, OSU College of Forestry) in the Tillamook State

Forest did not detect the species on their study plots. Although the northern Coast Range is primarily nonfederal land, some historic red tree vole populations of both subspecies are known from scattered locations on federally managed land. There were no reported pre-disturbance survey efforts during the past 5 years on federally managed lands, nor recent confirmations of extant historic sites on federally managed lands. The federal portion of the northern Coast Range contains the 250,000-acre Northern Coast Range Adaptive Management Area consisting of lands managed by the Siuslaw National Forest and the Salem District BLM. Because most late-successional forests have been harvested in the northern Coast Range (USDA, USDI 1994a, p. B-61), this Adaptive Management Area is managed for restoration and maintenance of late-successional forest conditions.

*Northern Oregon Cascades Subzone*: The Northern Oregon Cascades Subzone contains only 22 red tree vole sites on both federally managed and nonfederal land. The majority (13) of known federally managed sites are within the Bull Run watershed on the Mt. Hood National Forest. Major survey efforts by the Mt. Hood National Forest have found few new sites in habitat conditions where red tree voles were expected to be found.

The Mt. Hood National Forest, in 1995, reported surveying 38,611 acres under the Survey Protocol in use at that time, including 62 percent (26,976 acres) of all primary red tree vole habitats on the National Forest. Only 9 red tree vole sites were verified (USDA Mt. Hood National Forest 1996). Primary habitat on the Mt. Hood National Forest, defined as stands of large conifer (>21 inches dbh), below 3,200 feet elevation, within the western hemlock or Pacific silver fir vegetation zones, and in stands greater than 300 acres in size, included the most likely habitat for finding red tree voles. Additional surveys in 1997 added three additional nest sites. Although, the federally managed lands in the northern half of the Cascade Range have relatively few known sites, the results from the Mt. Hood National Forest surveys were below expectations. Museum specimen collection sites and the presence of red tree voles in owl pellet collections (Forsman et al. 1984) combined with the amount of likely habitat, suggested red tree voles should have been distributed throughout the region at some currently unknown density.

Approximately 57 percent of the Northern Oregon Cascades Subzone is designated Wilderness or Late-Successional Reserves. Over the next 100 years, the Late-Successional Reserves will provide large blocks of red tree vole habitat. In addition, Riparian Reserves are expected to develop older stand characteristic and provide some connectivity habitat between Late-Successional Reserves in the future. Based on field sampling of streams on 18 sections, Salem District BLM estimated up to 59 percent of the Salem District was in Riparian Reserves. The Mt. Hood National Forest estimated that approximately 30 percent of the Matrix on the westside of the forest was in Riparian Reserves (based on simple GIS mapping of known streams) and the Willamette National Forests estimated Riparian Reserves in the Matrix at 34 percent. The 30 to 34 percent estimates are possibly underestimated because all streams are not currently mapped in GIS layers. Therefore, it is reasonable to assume that between 30 and 59 percent of the Matrix on the Mt. Hood and Willamette National Forests are likely to be in Riparian Reserves. Based on these estimated Riparian Reserves in the Matrix, 15 to 26 percent of the landscape within the Northern Oregon Cascades Subzone will develop into older forest conditions along streams and, combined with the Late-Successional Reserves, 72 to 83 percent of the Northern Oregon Cascades Subzone will likely be red tree vole habitat in the future. This is similar to the Willamette National Forest estimates of “operable land base” at approximately 27 percent, which excludes all Late-Successional Reserves, Wilderness, known Riparian Reserves, Administratively Withdrawn Areas, soil stability buffers, etc. An operable land base of 27 percent indicates that 73 percent of the land area would not be available for tree harvest.

Estimates of the current vegetation condition within the Northern Oregon Cascades Subzone are not currently available for the Riparian Reserves and Matrix. Estimates of the current amount of red tree vole primary habitat is approximated by the amount of spotted owl nesting, roosting, and foraging habitat (greater than 80 years old). Stands identified as spotted owl nesting, roosting, and foraging habitat contain many of the characteristics of red tree vole primary habitat. Currently, 52 percent of Late-Successional Reserves on the Mt. Hood National Forest are in spotted owl nesting,

roosting, and foraging habitat. The remaining acres are 20 percent in stands 0 to 40 years of age and 28 percent in the age class 40 to 80 years old (Byford et al. 1998, Table 37). Projections presented by Byford and others (1998) indicate it will take 80 years for the Late-Successional Reserves within the Willamette Physiographic Province to attain the minimum spotted owl nesting, roosting, and foraging condition on 100 percent of the Late-Successional Reserve acres, assuming a linear growth pattern. The Late-Successional Reserves within the Willamette Physiographic Province currently contain approximately 57 percent primary red tree vole habitat, which represents approximately 35 percent of the land area in this subzone.

Higher elevation areas within the Late-Successional Reserves, above 3,200 feet, may be poor red tree vole habitat because forests above this elevation transition from western hemlock plant associations into cooler Pacific silver fir associations. Most of the current known sites on the Mt. Hood National Forest occurred in stands in the western hemlock associations and the extent to which red tree vole use the silver fir associations is unknown. The average elevation on the forest where stands transition from western hemlock and Pacific silver fir is 3,200 feet (Mellon, pers. comm.). Additional surveying within the Pacific silver fir association and modeling of plant association groups in the Northern Oregon Cascades Subzone could improve understanding of red tree vole use of the Pacific silver fir stands. If red tree voles do not occur in the silver fir associations, the amount of habitat and connectivity within Late-Successional Reserves would be reduced because many Late-Successional Reserves extend above 3,200 feet elevation.

Late-Successional Reserves, Wilderness areas, and Riparian Reserves account for 72 to 83 percent of the land area of the Northern Oregon Cascades Subzone and will become red tree vole habitat over the next 100 years. Federally managed lands in this subzone is primarily blocked within the National Forests. BLM managed lands are more of the classic checker-board or more fragmented. Since not all Late-Successional Reserves currently contain 100 percent late-successional forest conditions, and ingrowth over the next 80 years or more will be needed to attain minimum late-successional conditions (of stands greater than 80 years), some Late-Successional Reserve blocks may have a reduced likelihood of recolonization as late-successional habitat is established through ingrowth or a significant time-lag may occur between stands attaining late-successional characteristics and likely recolonization. Since the majority of the Northern Oregon Cascades Subzone is federally managed with little fragmentation due to ownership, the standards and guidelines are expected to function as designed within this subzone.

*Southern Willamette Valley Margin Subzone:* The southern Willamette Valley area of concern for connectivity of red tree vole habitat is comprised of the lowlands and foothills that border the southern Willamette Valley. Here, federally managed lands are managed primarily by the Eugene District BLM, with small portions managed by the Salem and Roseburg Districts. Most of the federally managed land is dispersed in the classic checkerboard ownership but a large number of small parcels, less than a section in size, are included in this subzone. This area includes the South Willamette/North Umpqua connective corridor, an area of concern for spotted owl habitat connectivity (Byford et al. 1998). This connective corridor contains connectivity blocks. Each habitat block is managed with a "Connectivity/Diversity Block Prescription" because of this area's importance as a connective bridge between spotted owl populations in the Cascades and Coast Range. The connectivity land allocation calls for maintaining each connectivity block in 25-30 percent late-successional forest, retaining 12-18 green trees per acre in all regeneration cuts, and a rotation length of 150 years (USDA, USDI 1994a and USDA, USDI 1994a).

The southern Willamette Valley historically contained old-forest conditions that are believed to have been high quality red tree vole habitat. These lower elevation forests close to human population centers were among the first forests harvested during the late 1800's and early 1900's (USDA et al. 1993, p. II-2). These harvested areas are thought to have included extensive tracts of potential red tree vole habitat on both nonfederal and federally managed lands. The connectivity land allocation within this subzone was estimated in 1998 to be comprised of 45 percent young plantations under 40 years old, 40 percent in stands 40-79 years old, and 15 percent suitable spotted owl habitat 80 years old or greater (Byford et al. 1998, p. 18). Approximately, 47 percent of the area is designated as Late-Successional Reserve/Adaptive Management Area and Riparian

Reserves provide additional potential habitat. Most recently identified sites contain low numbers of active red tree vole nests. The current practices on industrial (private) forest lands often result in harvest of entire sections around the federally managed parcels leaving the federally managed habitat isolated or with limited connectivity pathways. Given the checkerboard or more fragmented pattern of federally managed land, there are limited pathways for red tree vole dispersal except possibly through section corner to section corner connectivity between federally managed parcels.

Estimates of the current vegetation condition within the Southern Willamette Valley Margin Subzone are not currently available for the Riparian Reserves and Matrix. Estimates of the current amount of red tree vole primary habitat within the Late-Successional Reserves in this subzone can be approximated by the amount of spotted owl nesting, roosting, and foraging habitat. Currently, 45 percent of Late-Successional Reserve number RO222 is in spotted owl nesting, roosting, and foraging habitat. The remaining acres are 54 percent in stands 0 to 40 years of age and 2 percent in the age class 40 to 80 years old (Byford et al. 1998, Tables 22 and 24). Projections presented by Byford and others (1998) indicate it will take 80 years for the Late-Successional Reserve to attain the minimum spotted owl nesting, roosting, and foraging condition on 100 percent of the Late-Successional Reserve acres. The current low number of acres of primary red tree vole habitat within this Late-Successional Reserve reduces the likelihood that emigrants will recolonize some patches of reestablished habitat.

For a species with limited and patchy distribution and limited dispersal capability, the pattern of land ownership can have a substantial influence on species distribution. Management practices on nonfederal lands that reduce the amount or quality of late-successional forest will influence species distribution. If we assume that little late-successional forest will remain on nonfederal lands in this zone in the future, then significant gaps will be imposed on the distribution of the red tree vole due to land ownership alone. The proportions of federally managed lands designated as Late-Successional Reserve/Adaptive Management Area in this zone is important; 93 percent Northern Coast Range; 47 percent Southern Willamette Valley Margin; and 57 percent Northern Oregon Cascades. Over the next 100 years, management direction for federally managed land in this distribution zone will likely provide a substantial amount of red tree vole habitat on federally managed lands.

Based on the historical amount of old forest that originally occurred on all ownerships in the Northern Mesic Forest Zone, the current biological distribution of red tree vole habitat is believed to be reduced from the reference distribution pattern on all ownerships. In this case, alteration from historical distributions on federally managed lands is considered likely. Habitat on the federally managed lands is projected to contain gaps and other departures from historical conditions. Outcome 2 may be the best possible outcome, no matter what measures are taken to protect habitat on the federally managed lands. The current juxtaposition of the federally managed lands may isolate red tree vole habitat in the future and reduce the potential for connectivity between these habitat blocks.

Some Late-Successional Reserve blocks may not be recolonized or may have a reduced likelihood of recolonization because not all Late-Successional Reserves currently contain 100 percent late-successional forest conditions; ingrowth over the next 80 years or more will be needed to attain minimum late-successional conditions (of stands greater than 80 years); and the checkerboard or more fragmented pattern of federally managed lands.

Connectivity, habitat fragmentation, and a species' dispersal ability are scale-related issues that affect every species differently. The Northwest Forest Plan established the system of Late-Successional Reserves primarily at a scale needed for the spotted owl and other similarly mobile species. While those large reserves will function as large habitat blocks capable of maintaining red tree voles and other poor dispersers, the spacing of those reserves blocks tend to isolate the populations within them. The FEMAT report characterized connectivity as very strong for relatively short distances of less than 6 miles (USDA et al. 1993, p. VI-52). The Riparian Reserves help provide a bridge that connects the large habitat blocks. However, for a red tree vole

population in the middle of a 6-mile stretch of Riparian Reserves, a 3-mile movement is at a multi-generational scale. The scale of habitat fragmentation induced by the pattern of federally managed lands and private land ownership can introduce habitat gaps in the range of one square mile to tens of square miles, which can be an additional isolating mechanism for local populations. The cumulative effects assessment conducted for the Final SEIS (Appendix J2, p. J2- 474) also concluded that “the only cumulative effects that may impact viability of red tree voles in Oregon is the amount and distribution of federal and nonfederal lands within the species range.”

In the case of the Northern Coast Range Subzone, a significant gap will occur between federally managed habitat in this region and other federally managed habitat in the Coast Range from land ownership patterns. The distribution of red tree vole sites on federally managed lands is limited, but should improve as habitat conditions change under the current management of restoration and maintenance of late-successional forest conditions for the marbled murrelet. However, it is likely the pattern of red tree vole distribution will remain altered from reference distributions in the northern Coast Range.

In the southern Willamette Valley Margin Subzone, concerns for connectivity of potential red tree vole habitat is due to the gap in federally managed lands across the Interstate 5 corridor and other gaps imposed by the distribution of federally managed land and the juxtaposition of small federally managed parcels. In addition, the high percentage of the connectivity land allocation in stands of age classes 0 to 80 years suggests a significant time-lag between stands attaining late-successional characteristics and the likely recolonization by red tree voles.

### **Xeric Forest Distribution Zone**

The Xeric Forest Distribution Zone is comprised primarily of the portion of the red tree vole’s known and suspected range on the Klamath National Forest in northern California and the dry conifer forest surrounding the Rogue and Illinois River Valleys in southern Oregon. The majority of this zone was added to the known and suspected range in the last 6 years. There is concern with red tree vole habitat in this zone due to natural fragmentation and limited amounts of mesic forest conditions combined with the small number of confirmed sites. In the Rogue River basin, this xeric habitat is in a belt between the mesic forests conditions found in the Mesic Forest Distribution Zone and the very dry oak woodlands of the Rogue River Valley. These xeric forests were not traditionally believed to be habitat and there is a poor understanding of red tree vole distribution or habitat relationships in these forests. Red tree vole habitat naturally becomes more isolated with progressively less connectivity toward the edges of this zone where it intergrades with the oak woodlands.

The biological distribution of red tree vole sites and populations within the Xeric Forest Distribution Zone show a pattern of relatively isolated sites of one to few nest trees (Zentner 1977; USDA, USDI Species Review Panel 2000b) or small isolated groups or clusters of sites with some potential for gene flow. There is uncertainty regarding the distribution of sites in northern California. The majority of red tree vole sites identified by Zentner (1977) in the eastern Klamath Mountains contained only single nests and the few “breeding colonies” which generally contained only 3 to 5 active nests each.

Pre-disturbance surveys, as required by the Survey and Manage Standards and Guidelines, will identify additional sites in the Southern General Forest Management Area of the Medford District BLM. The identification and management of these sites should help reduce the risk of extirpation in these dry forest types. In the dry forest types, natural fragmentation and distribution of mesic forest conditions are different than in the northern Coast Range or Cascades, leading to different red tree vole persistence concerns. Pre-disturbance and regional surveys in this area located sites containing evidence of current and past red tree vole use and these sites helped delineate the southeastern boundary of the species known and suspected range. Pre-disturbance surveys in the drier forests of southern Oregon are finding red tree voles in stands with large trees, in more varied conditions than just mesic old-growth stands.



Red tree vole abundance in this zone has generally been low. The Grants Pass Resource Area surveyed 101 potential timber units in 1996 and 1997 and found few red tree vole sites. The surveys were distributed over five fifth-field watersheds. They sampled from 4 to 21 potential sale units per watershed and surveys covered from 40 to 100 percent of the acres of the units. Red tree vole nests, both active and inactive nests, were confirmed in 14 (13.9 percent) of the 101 stands. Of 61 confirmed red tree vole nests in these units, 26 nests (43 percent) were considered active and 46 percent (12) of the active nests were found in a single proposed timber sale unit. Nest tree densities, estimated by combining both “active” and “undetermined use” categories of nests in the 14 occupied stands, averaged 0.17 (standard error 0.07) nest trees per acre (USDA, USDI Species Review Panel 1999b).

Compared to the Grants Pass Resource Area results, red tree vole nest tree densities were 12 times higher in a Coast Range study of 16 mesic stands (9 old, 7 young) in the Rock Creek watershed. The Coast Range study found considerably more nest trees per acre in stands greater than 125 years old than in stands 30-125 years. Mean nest tree densities were 2.04 (standard error 0.46) nest trees per acre in the older stands and 0.45 (standard error 0.33) nest trees per acre in the younger stands (USDA, USDI Species Review Panel 1999a). The lower densities and fewer numbers of stands containing red tree vole nests on timber sale units in the Grants Pass Resource Area likely reflect the effect of the dry climate and more limited habitat conditions generally found in this region.

The dry forest communities of southern Oregon and northern California evolved with natural fire and, under the Northwest Forest Plan, prescribed fire will be reintroduced. There is some concern about the effects of reintroducing fire on red tree vole sites. While there is considerable risk of catastrophic loss of red tree vole sites due to wildfires, little is known regarding the effects of fuels management projects. Red tree voles are year-round residents of the canopy and build nests primarily in the lower half of the live crown. These characteristics suggest vulnerability of nests to heat and crown scorching during a fire.

The likely risks to the species within this zone are associated with the potential loss or disturbance of strategic populations in the dry forests of the Rogue River Valley and Siskiyou Mountains, where canopy structural characteristics and moisture requirements for this species are met in a relatively narrow set of mesic forest habitat conditions. Suitable habitat is patchy in distribution across this landscape. The amount and distribution of mesic forest conditions are extremely limited within this region (Johnson and George 1991). Considerable change in plant community and stand structural conditions can occur with relatively slight changes in aspect or topography. Therefore, maintaining stands large enough, and with the appropriate moisture conditions to support red tree voles, is critical to managing this species under these conditions. In addition, all sites reported to date from the dry Rogue River Valley and Siskiyou Mountains appear to have few individuals per site based on the number of nest trees detected. Limited number of individuals per site might indicate that some of these sites are less secure because of their small size and limited spatial extent.

Approximately 46 percent of the sites known prior to implementation of the Northwest Forest Plan occur within reserve land allocations and are approximately distributed as follows: 3 percent within Congressionally Withdrawn areas; 2 percent within Administratively Withdrawn areas; and 38 percent within Late-Successional Reserves. Of the remaining sites, 17 percent are within Adaptive Management Areas and 37 percent are within Matrix/Riparian Reserves. However, due to the spatial resolution of mapped red tree vole locations, Riparian Reserves cannot be differentiated from the general Matrix land allocation. Sites reported prior to 1994 may no longer be extant, particularly on nonfederal lands, because of adverse impacts from land management activities on habitat at these sites. Almost all recent federal sites (sites found after 1994) have been found in Matrix/Riparian Reserve allocations, due to the emphasis of completing surveys in areas where habitat-disturbing activities are proposed. About 27 percent of the known and suspected range of the species across all ownerships is in reserve land allocations excluding Riparian Reserves. Based on estimates using the BLM's Western Oregon Digital Image Project

vegetation map for western Oregon, approximately 35 percent of the potential primary red tree vole habitat in Oregon is within these reserve allocations: Congressionally Withdrawn Areas, Administratively Withdrawn Areas, and Late-Successional Reserves (USDA, USDI 1999b).

Within the range of the red tree vole, approximately 34 percent of the land base designated as Congressionally Withdrawn, Late-Successional Reserve, and Administratively Withdrawn is currently in conifer stands with dominant and codominant trees averaging greater than or equal to a 20-inch dbh threshold (USDA, USDI Species Review Panel 1999b). While some nests have been found in stands with canopy trees less than 20 inches dbh, the majority of sites with higher population levels (greater than 2 active trees per acre) have been in stands with dominant and codominant trees averaging greater than or equal to 20 inches dbh. This suggests that, currently, much of the reserve lands are not likely to provide good habitat for red tree voles. Additionally, land management activities, such as understory fuel treatment with prescribed fire, are permitted in Late-Successional Reserves below the Grants Pass line that delineates the Southern General Forest Management Area (USDA, USDI 1994a and USDA, USDI 1994b, p. C-42), which may impact red tree voles in southern Oregon.

Understanding of the geographic range of the red tree vole has improved since the issuance of the Northwest Forest Plan Record of Decision. The Medford District BLM and Pacific Northwest Research Station have surveyed 521 locations and identified 211 new red tree vole sites in the Rogue, Applegate, and Illinois River Valleys. This expanded the understanding and delineation of the eastern extent of the red tree vole range in these dry forest landscapes. The most notable change in the species range since initiation of the Northwest Forest Plan is a clarification in the taxonomic relationship of populations in northern California. In the Northwest Forest Plan Final SEIS, the Agencies followed the range suggested by Johnson and George (1991) when they split the sibling species, the California red tree vole (*Arborimus pomo*) from the Oregon red tree vole. They suggested a break in distribution between the two species near the California/Oregon border. Murray (1995) has subsequently presented new information, based on DNA analysis, suggesting specimens from the Smith River area in Del Norte County, California, are more similar to the Oregon red tree vole than to other California populations. In addition, Maser (1998), based on his collecting in the Smith River watershed, also suggests the Smith River population are the Oregon red tree vole.

Recently published studies have concluded that red tree voles are more abundant in older forest conditions, such as older mature and old-growth forests (Gillesberg and Carey 1991; Gomez 1992; Huff et al. 1992; Meiselman and Doyle 1996; Carey 1989; and Corn and Bury 1986 and 1991) than in younger stand conditions. However, some red tree vole nests are found in younger stands. For example, Gomez (1992) captured red tree voles in old-growth stands 4.1 times more frequently than in large saw timber, and over 17 times more frequently than in stands of pole-sized trees in the Oregon Coast Range. While the species has been captured or detected in almost all seral stages of Douglas-fir forests (Carey 1989 and Maser et al. 1981), it occurs with the greatest frequency and reaches greatest densities in old-forest conditions (Corn and Bury 1986 and 1991; Carey 1989; and Meiselman and Doyle 1996). The Coos Bay District BLM, in their 1998 summary of known sites, listed nest tree conditions at 12 of 28 nest locations as nests in trees with diameters of 22 to 52 inches dbh. The Glendale Resource Area surveyed 79 potential timber harvest units in 1997. Red tree vole nests were located in 76 percent (60) of the units. Based on the Forest Operations Inventory, all of these stands contained trees greater than 21 inches dbh, were mixed aged/multilayered stands containing large trees as an overstory component of the stand, or were classified as small saw-timber (11 to 21 inches dbh) that usually contained scattered trees greater than 21 inches dbh. All of these surveys indicate that red tree voles still exploit the structural characteristics of larger trees throughout their southern range (USDA, USDI Species Review Panel 1999a).

Revisions of the red tree vole Survey Protocol occurred during the fall of 1999. Revisions to the Management Recommendations were completed in September 2000. This analysis assumes that additional revisions to the Survey Protocol and Management Recommendations will be made as

new information suggests improvements. Management Recommendations will incorporate the best biological information and be modified, as needed, to assure persistence of the taxon at sites where they occur.

In general, pre-disturbance surveys since the Northwest Forest Plan have not indicated the species is more abundant than previously expected. Surveys have found new localities, but, to date, the data has not clarified habitat relationships for the species. Surveys have not found red tree voles to be very abundant in many younger lowland forests in the northern third of its range (USDA, USDI Species Review Panel 1999a) in areas where they were previously collected. Other survey efforts, such as the Mt. Hood National Forest surveys (1996), have not located many sites despite substantial survey effort in habitat conditions where they were expected to occur. The majority of the sites found after 1994 reflect survey efforts to implement the Northwest Forest Plan Survey and Manage Standards and Guidelines. For most new sites, all that is known is that a red tree vole nest was detected. There is a lack of information specific to the status of the populations, habitat characteristics, patterns of abundance, and pattern of distribution for these sites. In addition, sites identified prior to 1994 have not been revisited to determine if populations are still present and some of these older sites may no longer be extant.

Taxa experts concluded, during the FEMAT panel assessment process, that the standards and guidelines under Option 9 would result in a 73 percent likelihood of Outcome A, under which red tree voles would have “habitat of sufficient quality, distribution, and abundance to allow the species to stabilize, well distributed across federally managed lands.” However, the panelists also concluded there was a 25 percent likelihood of an Outcome B, where red tree vole populations would “stabilize, but with significant gaps in the historic species distribution on federal lands. These gaps cause some limitation in interactions among local populations” (USDA et al. 1993, p. IV-43 and Table IV-38). In addition, FEMAT concluded that “Forest management on non-federal lands in northwestern California and western Oregon could be important for both species of red tree voles” (USDA et al. 1993, p. IV-175). However, implementation of Riparian Reserve Scenario 2 and protection of known sites in the Matrix was “likely to improve breeding and dispersal habitat for the species throughout its range and increase the likelihood of achieving Outcome A to >80 percent under Alternative 9” (USDA, USDI 1994, p. J2- 475). However, Appendix J2 (USDA, USDI 1994a, pp. J2-473 through J2-475) raised concerns over the potential risk of genetic isolation of red tree vole populations. Appendix J2 states that the red tree vole is most abundant in late-successional forest, so populations are likely to be sparse in the Matrix in the future. The species also has limited dispersal capability, so forest fragmentation may limit connectivity between populations in the reserves. Available new information does not alter these conclusions. The species is still most abundant in stands with old-forest characteristics (i.e., trees with large limbs and well-developed crowns).

Overall, this species was included in the Survey and Manage Standards and Guidelines due to concerns for: (1) the relatively low number of known sites within the species large geographic range; (2) the limited and patchy distribution of known sites across the known and suspected range of the species; (3) concern for the species limited dispersal capabilities; (4) the likely amount of connectivity between older forest patches that may be important to metapopulation function; and, (5) the sensitivity of the species to habitat disturbance. FEMAT panel ratings were partially a result of poor information on abundance, distribution, and dispersal capabilities of the species (USDA, USDI 1994a, Appendix J2, p. J2-474).

Four basic assumptions regarding the effects of the Northwest Forest Plan and conclusions of previous analysis efforts were brought forward to this analysis. These assumptions and conclusions are:

1. Red tree voles were added to the Survey and Manage mitigation measure during the Northwest Forest Plan Final SEIS because the species was believed to need more protection than provided by reserve land allocations and other standards and guidelines of the Northwest Forest Plan. Available new information does not alter this conclusion. Therefore, the analysis in this SEIS assumes that stable, well-distributed

red tree vole populations are dependent to some extent on maintaining some red tree vole populations within the Matrix at a level capable of re-occupying areas as stand conditions improve as a result of other standards and guidelines provided in the Northwest Forest Plan.

2. Most timber harvest over the next decade would occur in late-successional stands (see Timber Harvest section in this chapter and Johnson et al. 1993).
3. As described in the Northwest Forest Plan, Late-Successional Reserves below the Grants Pass line that delineates the Southern General Forest Management Area (USDA, USDI 1994a and USDA, USDI 1994b, p. C-42) would have prescribed fire reintroduced into the ecosystem.
4. These Late-Successional Reserves would be subject to some canopy-disturbing projects, such as thinning in stands less than 80 years old (USDA, USDI 1994a, Appendix B, pp. 7 and 8).

Four primary data sources were used to estimate the number of pre-1994 and recent (post-1994) red tree vole sites. Pre-1994 sites were estimated by assessing published lists of museum specimens and species collection sites where the species had been found prior to the Northwest Forest Plan. Attempts were made to remove any duplicate collection areas. Estimates of recently detected sites were derived from queries of two databases: the 1998 PNW red tree vole database and the 1999 ISMS database. The PNW database was created from information submitted in response to a 1998 data request to all National Forests and BLM offices in western Oregon. The ISMS database contains information provided in response to a 1999 data request for all new survey data collected since the 1998 PNW request. The two databases were error checked, merged, checked for duplicates, and queried for the number of locations. In addition, Roseburg District BLM provided preliminary summaries of their red tree vole surveys conducted between November 1999 and February 2000 (McGraw 2000). The estimates obtained from these four sources appear to reflect reasonable estimates of the number of known sites, including both extant and non-extant populations.

As stated in Chapter 2, and based on new data collected in 1999, the species review panel re-examined the assignment of species into categories. Based on that review, there was no change in the assignment of the red tree vole in the various categories. Table F-2 (Appendix F) documents the reasons for assigning the red tree vole into the Survey and Manage categories.

#### Differences between the Northwest Forest Plan Final SEIS and this Final SEIS

Some of the outcomes in this assessment may seem to differ from the overall conclusions of the Northwest Forest Plan Final SEIS. However, the taxa experts, during the FEMAT panel assessment process, concluded that the standards and guidelines under Option 9 would result in a 73 percent likelihood of “habitat of sufficient quality, distribution, and abundance to allow the species to stabilize, well distributed across federally managed lands.” However, the panelist also concluded there was a 25 percent likelihood of an Outcome B, where red tree vole populations would “stabilize, but with significant gaps in the historic species distribution on federal lands” (USDA et al. 1993, p. IV-43 and Table IV-38). In addition, FEMAT concluded that management on nonfederal lands in western Oregon could be important for both species of red tree voles (USDA et al. 1993, p. IV-175). The FEMAT and Final SEIS analysis never reviewed actual species distribution or species specific habitat distributions for individual Survey and Manage taxa. The difference in this assessment reflects closer analysis of local ownership, historical distributions, habitat conditions, and known site information on a sub-regional basis that was not available during the Northwest Forest Plan Final SEIS analysis. This finer scale analysis is more likely to identify gaps or local distribution problems that may not have been accounted for on a range-wide assessment. These changes in outcomes are sub-regional and do not affect the range-wide outcome.

## Environmental Consequences and Comparison of Alternatives

The alternatives propose adjustments to the management direction for the red tree vole. Alternatives 1, 2, and 3 would reassign the red tree vole to a different Survey and Manage category and apply different management standards and guidelines than the No-Action Alternative.

The environmental consequences of three of the four alternatives presented in this SEIS have similar effects on the management of the red tree vole. There are slight differences between the alternatives in the categories they assign the red tree vole; overall, the No-Action Alternative and Alternatives 1 and 3 have the same outcome for the species.

### The No-Action Alternative

The No-Action Alternative would continue the current management as directed in the Northwest Forest Plan. The red tree vole would remain a Category 2 species. Pre-disturbance surveys would be required prior to habitat-disturbing activities within the red tree vole's geographic range to help protect red tree voles by identifying new sites and avoiding the inadvertent loss of nest sites. Riparian Reserves may provide incidental habitat protection where sites occur near aquatic habitat. Where surveys are completed, the information would be used to manage sites for the species and Management Recommendations would be developed to manage habitat on sites where they are located (USDA, USDI 1994a and USDA, USDI 1994b, p. C-5).

Under the No-Action Alternative, pre-disturbance surveys help protect red tree voles in the Matrix by identifying new sites and avoiding inadvertent loss of sites. Pre-disturbance surveys are conducted only where habitat-disturbing activities are planned, do not collect quantitative data on species abundance, and do not determine population trend or other demographic information essential to develop or improve Management Recommendations. Pre-disturbance surveys do have the potential to find more new sites than strategic surveys because of the magnitude of this effort. Strategic surveys may gather a wider range of ecological information, but they are not required in the No-Action Alternative.

### Alternatives 1 and 3

Alternatives 1 and 3 are similar in regard to their management of the red tree vole. Under Alternative 1, the red tree vole is assigned to Category 1C (uncommon, pre-disturbance surveys practical) and to Category 3B (uncommon) under Alternative 3. Under these categories, all current and future known sites would be managed until high-priority sites could be determined. Pre-disturbance surveys would be conducted to minimize the inadvertent loss of undiscovered sites. Strategic Surveys would be conducted to gather information needed to develop long-term Management Recommendations, prioritize selection of high-priority sites, and improve survey protocols. Alternatives 1 and 3 change the management standards from "manage habitat for the species on sites where they are located" (Northwest Forest Plan ROD, p. C-5) under the No-Action Alternative to identifying and managing high-priority sites. Until high-priority sites are identified, the current Management Recommendations would continue. The high-priority sites would include all current and future sites necessary to maintain persistence of the species. This would include protection of sites necessary to maintain stable, well-distributed populations of the species in the Northwest Forest Plan area and sites needed to avoid isolating local populations. Currently there is insufficient information for the selection of high-priority sites. Development of prioritization criteria would require information acquired through Strategic Surveys.

After high-priority sites are identified (those needed to ensure a reasonable likelihood for species persistence) or after methods for determining which future sites are high priority are developed, management activities at sites not determined to be high priority might result in site loss. This species is uncommon, as opposed to rare, and could reasonably be maintained in the Mesic Forest Zone with only a proportion of its known sites managed.

Alternative 3 is similar to Alternative 1 relative to its effects on the persistence of this species. The objective of the strategic surveys, under Alternative 3, is to find the most important habitat for the species and determine the ability of reserves to provide for the species persistence. This slightly greater emphasis on survey efforts in the reserve land allocations is consistent with the need to identify and manage red tree vole habitat. Knowledge of the status of red tree vole populations and habitat conditions within the reserve land allocations would allow a better assessment of the importance of Matrix populations in their role of providing prey for spotted owl populations as well as maintaining well-distributed red tree vole populations.

The addition of strategic surveys under Alternatives 1 and 3 have important implications because they provide valuable information needed to assess the species' present status and develop Management Recommendations. There are critical gaps in the understanding of red tree vole ecology. Strategic surveys would help further refine and revise the Survey Protocol and provide information for development of long-term Management Recommendations. Determining the most important habitat for the species will require an understanding of the genetic variations within and among isolated populations or metapopulations and population demographic information. In regions where there are limited Late-Successional Reserves (on a subregional scale) or limited federally managed lands, such as the north Coast Range, knowledge of the status of the few Matrix sites is important to understanding the risks to red tree vole persistence.

An advantage of Alternatives 1 and 3 over the No-Action Alternative is the ability to identify high-priority sites and develop Management Recommendations for them. Rather than attempt to manage all sites now and in the future (as under the No-Action Alternative), Alternatives 1 and 3 provide the latitude to select and manage sites of appropriate size and with sufficient habitat to ensure red tree voles can persist at that location. Currently, many sites appear to have few individuals and occupy very small habitat patches, two factors that suggest these sites may not persist over time. The broader scope of managing high-priority sites, without the need to manage all sites, may provide a potentially more successful management strategy. The Management Recommendation could consider the aggregation of sites that form a more biologically-important population or metapopulation. Connectivity among sites or sub-populations can more easily be considered when identifying high-priority sites under Alternatives 1 and 3 than under the No-Action Alternative. Any future consideration of connectivity areas or "additional or in-lieu-of" habitat management direction would be subject to appropriate NEPA analysis.

#### Mesic Forest Distribution Zone

Since the Mesic Forest Distribution Zone is the largest zone and likely contains a larger proportion of primary red tree vole habitat and large blocks of Late-Successional Reserves, changes in the distribution patterns from the reference distribution are less likely. The No-Action Alternative and Alternatives 1 and 3 would continue current Northwest Forest Plan direction to manage known sites (as long as the species is included in a Survey and Manage category requiring known site management). Alternatives 1 and 3 allow for the management of high-priority sites if, and when, Management Recommendations identify criteria under which high-priority sites can be identified. While there is a high level of uncertainty due to lack of knowledge regarding current population trends, dispersal, and amount of gene flow and connectivity between populations, the No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution within the Mesic Forest Distribution Zone.

#### Northern Mesic Forest Distribution Zone

Northern Coast Range Subzone: While there is a high level of uncertainty due to lack of knowledge regarding current population trends, dispersal, and amount of gene flow and connectivity between populations within the Northern Coast Range Subzone, management will likely provide sufficient habitat to allow the species to stabilize in a pattern similar to its reference distribution on federally managed lands. However, the cumulative effects of land ownership patterns reduce the likelihood of recolonization as late-successional habitat is established through ingrowth because gaps in federally managed lands and the juxtaposition of small federally

managed parcels may limit or prevent colonization in the future. The cumulative effects of land ownership under the No-Action Alternative and Alternatives 1 and 3 will likely provide sufficient habitat to allow the species to stabilize in a pattern different from the reference distribution because land ownership patterns strongly influence the species' future distribution within this subzone.

Overall, management practices on nonfederal lands reduces the potential connectivity between large blocks of federally managed lands, and the cumulative effect of the current patterns including nonfederal lands results in Outcome 2. Over 93 percent of the federally managed lands in the Northern Coast Range Subzone are Late-Successional Reserve or Late-Successional Reserve-like in their management and there does not appear to be any additional mitigation available to affect the outcome on federally managed lands.

Northern Oregon Cascades Subzone: Late-Successional Reserves, Wilderness Areas, and Riparian Reserves account for 72 to 83 percent of the land area of the Northern Oregon Cascade Subzone and much is likely to become red tree vole habitat over the next 100 years. Federally managed land in this subzone is primarily blocked within the National Forests. While not all Late-Successional Reserves currently contain 100 percent late-successional forest conditions, ingrowth over the next 80 years will allow the Late-Successional Reserves to attain minimum late-successional conditions (of stands greater than 80 years). Some Late-Successional Reserve blocks may have a time-lag between the stands attaining late-successional characteristics and likely recolonization. However, the majority of the Northern Oregon Cascades Subzone is federally managed lands with little fragmentation due to ownership. Therefore, the standards and guidelines are expected to function as designed within this subzone. While there is a high level of uncertainty due to lack of knowledge regarding current population trends, dispersal, and amount of gene flow and connectivity between populations, the No-Action Alternative and Alternatives 1 and 3 would provide sufficient habitat (including known sites) to allow the species to stabilize in a pattern similar to its reference distribution within the Northern Oregon Cascades Subzone.

Southern Willamette Valley Margin Subzone: While there is a high level of uncertainty due to lack of knowledge regarding current population trends, dispersal, and amount of gene flow and connectivity between populations within the Southern Willamette Valley Margin Subzone, management over the next 100 years would likely provide sufficient habitat to allow the species to stabilize in a pattern similar to its reference distribution on federally managed lands. However, the cumulative effects of land ownership patterns and the current amount of primary red tree vole habitat within the Late-Successional Reserves reduces the likelihood of recolonization as late-successional habitat is established through ingrowth. Gaps in the federally managed lands and the juxtaposition of small federally managed parcels may limit or prevent colonization of future habitat. Because of the cumulative effects of land ownership, the No-Action Alternative and Alternatives 1 and 3 will likely provide sufficient habitat to allow the species to stabilize in a pattern different from the reference distribution on federal and nonfederal lands combined because land ownership patterns and management practices on nonfederal land within this subzone strongly influence the species' future distribution.

Any mitigation measure that would ensure the persistence of current red tree vole populations within this subzone and that would also improve the likelihood that the current sites remain connected would likely raise the outcome in this subzone. Measures such as the establishment of larger habitat areas around current sites, particularly sites with large numbers of active nests, would help maintain current sites. In addition, maintaining patches of primary habitat (even if currently unoccupied) near large active sites might improve the outlook for connectivity.

#### Xeric Forest Distribution Zone

There is insufficient information regarding this species to determine how any alternative would affect distribution and stability within the Xeric Forest Distribution Zone, particularly the portion of the red tree vole's known and suspected range on the Klamath National Forest in northern California. The majority of the Xeric Forest Zone was added to the known and suspected range since the Northwest Forest Plan. Forest conditions within the zone are significantly drier than the

remainder of the species' geographic range and favorable habitat conditions seem to be limited. However, the relative short time since the red tree vole sites within this zone were identified has not allowed for sufficient studies within this area to determine habitat relationships. Questions regarding suitable habitat and distribution of sites need to be answered before it will be possible to determine how the species may be affected by the alternatives.

During the FEMAT analysis most of the area within the Xeric Forest Distribution Zone was believed to have been outside the range of the species or on the marginal edge of the species range in Oregon. Although there are site records for red tree vole within this zone that pre-date the FEMAT analysis, no assessment of known sites or searches of museum records was conducted by the FEMAT analysis team. Because this species is arboreal and difficult to study, few quantitative research projects have been conducted on the species anywhere within its geographic range. Therefore, little is known regarding the species in this Xeric Forest Zone where red tree vole sites are sparsely distributed and their primary habitat apparently is naturally limited.

## Alternative 2

Under Alternative 2, red tree voles are assigned to Category 2D (Uncommon). All sites known as of September 30, 1999, would continue to be managed for the next 5 years. No new pre-disturbance surveys would be required and strategic surveys would be completed within 5 years. Based on the 5 years of strategic survey information, the species would be assigned to the Agencies' special status species programs or removed from special management consideration because no additional species-specific provisions would be needed. Management of existing known sites for the red tree vole would continue until a decision was made whether to include the species in the special status species programs.

Alternative 2 results in substantial effects and uncertainty on the future status of the red tree vole. Under the Interim Survey Protocol, 10 to 12 BLM Districts and National Forests were not required to conduct surveys for red tree voles (USDA, USDI Species Review Panel 1999b). The interim protocol produced an uneven distribution of survey effort across the known and suspected range. A substantial portion of the species range, including northern California and the Oregon Coast Range, is exposed to inadvertent loss of populations needed to maintain the species distribution and connectivity between Late-Successional Reserves because no surveys were conducted in a significant portion of the range before September 30, 1999. The requirement to only manage those known sites identified as of September 30, 1999, and to not conduct pre-disturbance surveys for future habitat-disturbing activities would increase the risk of losing sites needed to maintain connectivity throughout all three red tree vole distribution zones. This, in turn, would increase the risk of isolation of red tree vole populations and likely reduce gene flow between Late-Successional Reserves. Some Late-Successional Reserves may not be recolonized or have a reduced likelihood of recolonization because (1) not all Late-Successional Reserves currently contain 100 percent late-successional forest conditions; (2) ingrowth over the next 80 years or more will be needed to attain minimum late-successional conditions in some Late-Successional Reserves; (3) fragmented patterns of federally managed lands; and, (4) newly discovered nest sites in the Matrix will not be protected. Therefore, while there is a moderate level of uncertainty due to lack of knowledge regarding dispersal, current population trends, and gene flow between populations, Alternative 2 would provide inadequate habitat to maintain stable populations of the species in all three red tree vole distribution zones due to the lack of connectivity between Late-Successional Reserves and habitat patches in the Matrix.

Alternative 2 creates uncertainty in how the species would be managed following the 5-year interval. Given our limited knowledge of red tree vole population dynamics and ecology, the 5-year timeframe is not likely to be sufficient for completion of the studies necessary to make an informed recommendation to the species future disposition. Pre-disturbance surveys are only now starting to locate red tree vole populations in many areas. To develop Management Recommendations to manage habitat for stable, well-distributed populations of red tree voles on federally managed lands, biologists and managers need information on genetic variation between populations and other population-based data. Information on the genetic variation between these



small isolated populations, combined with studies of red tree vole population trend, longevity, demographics, and population densities, require collection of data over several generations of red tree voles (more than 5 years). The other three alternatives do not have restrictions on pre-disturbance surveys, nor the time limit on protection measures for this species.

Overall, Alternative 2 could increase the risk that the red tree vole may decline throughout its range and that the remaining populations could become more isolated because this alternative would only protect currently known sites and would allow only 5 years to complete strategic surveys. The limited and uneven distribution of survey efforts over a large portion of the species range has resulted in few, if any, known sites in these inadequately surveyed areas. The distribution of currently known sites is insufficient, by itself, to provide for stable or well-distributed populations of this species in the long term. Therefore, failure to locate and protect additional sites would increase the likelihood of isolating the remaining populations. Increasingly isolated populations are less likely to remain stable in the long-term. In addition, information on population trends and population structure is important to determining the location and conditions for high-priority sites for management that may protect against isolation and inbreeding. Information necessary to answer these questions may require more than 5 years to collect. While there is a moderate level of uncertainty due to lack of knowledge regarding dispersal, current population trends, and gene flow between populations, Alternative 2 would provide inadequate habitat to maintain stable populations of the species in all three red tree vole distribution zones.

Implementation of strategic surveys under all three action alternatives is vital to improving the understanding of red tree vole ecology, distribution, habitat relationships, population trends, and management options. The information gained through the process is essential to scientifically credible Management Recommendations in order to maintain habitat for stable, well-distributed populations. Current Survey Protocols and Management Recommendations could be improved with new information on the species reproductive potential, demographics, population status or trend, and the spatial extent of populations at known sites. Identifying high-priority sites for management without a better understanding of red tree vole ecology could increase the risks to red tree voles because of the uncertainties associated with a lack of information that could be provided by strategic surveys.

This species has many life history characteristics, including low dispersal capability, low reproduction potential, and a sensitivity to habitat disturbances, that cumulatively raise concerns for this species. Generally, the scientific information needed for management has not come solely from pre-disturbance surveys. To date, pre-disturbance survey information has been limited to locating sites and collecting counts of the number of nests trees within project areas. Strategic surveys are intended to (1) refine habitat characterization; (2) provide information on how to manage species or their habitat (particularly at known sites); (3) provide information for the identification of high-priority sites for management; and, (4) address specific questions (e.g., determining whether a species is still extant at a specific location or conducting studies to examine specific disturbance effects on persistence of individuals at a site). With this information, Management Recommendations will provide improved, efficient, scientifically-based recommendations.

Given the category the Step 3 panel assigned the red tree vole to during the Species Review Process, Alternatives 1 and 3 are similar relative to their effects on red tree voles. Both maintain similar pre-disturbance surveys and contain strategic surveys. The pre-disturbance surveys minimize the inadvertent loss of undiscovered sites, while Alternative 2 does not minimize this loss. Strategic surveys under Alternatives 1 and 3 provide needed ecological information on the species without the time limits imposed by Alternative 2. Alternatives 1 and 3 protect all current and future known sites until high-priority sites are identified and provide Management Recommendations for the long-term species management rather than possibly moving the species into the Agencies' special status species programs. Alternatives 1 and 3 give the best overall protections to the species because they maintain pre-disturbance surveys and manage current and future high-priority sites. Finally, strategic surveys conducted under these alternatives provide

critical information on population status, life history, and habitat relationships to improve site management and the selection of high-priority sites for management.

The Northwest Forest Plan was designed to provide for habitats to support species closely associated with late-successional and old-growth forests on federally managed lands. Maintaining the persistence of red tree voles requires providing, within the planning area, habitat sufficient to allow the species to stabilize in a pattern similar to its reference distribution. Alternatives 1 and 3 provide the best combination of pre-disturbance surveys, strategic surveys, and options for Management Recommendations to provide for persistence of the red tree vole. Alternative 2 decreases the assurance to persistence because it may not ensure that the species remains well distributed in the Northwest Forest Plan area and that populations remain stable. Alternative 2 creates uncertainty in how the species would be managed following the 5-year survey interval. The No-Action Alternative also provides less assurance of red tree vole persistence by not providing for strategic surveys, which would improve the Agencies ability to develop effective Survey Protocols and long-term Management Recommendations.

### **Three Basic Criteria for Survey and Manage**

1. The species must occur within the Northwest Forest Plan area, or occur close to the NFP area and have potentially suitable habitat within the NFP area.
2. The species must be closely associated with late-successional or old-growth forest (see Appendix E).
3. The reserve system and other Standards and Guidelines of the Northwest Forest Plan do not appear to provide for a reasonable assurance of species persistence.

## **Provision to Add Species to Survey and Manage**

Each of the action alternatives includes a provision for adding published taxonomic entities to Survey and Manage in the future. To add species to Survey and Manage, the Agencies must have information indicating the species meets the first two of the Survey and Manage Basic Criteria, and meets the criteria for concern for persistence listed in Chapter 2 of this SEIS. Because species may be added to Survey and Manage in the absence of sufficient information to judge compliance with the third basic criteria, species may be added to any category (except Category 2D in Alternative 2). Once a species is added, strategic surveys will provide necessary information to assess whether the species needs the Survey and Manage Standards and Guidelines to provide a reasonable assurance of persistence, or whether it should be removed.

The provision for adding species in Alternative 2 is the same, except that no species will be added to the uncommon category. Because species may be added only to the rare categories, the criteria indicating a concern for persistence are different when compared to the other alternatives.

## **Background and Affected Environment**

The Northwest Forest Plan has no specific provision to add species to Survey and Manage. The more than 400 species on Survey and Manage in the No-Action Alternative are generally the species that the FEMAT viability panels rated as not likely to be reasonably well distributed under other elements of the Northwest Forest Plan, because of uncertainty, endemism, small population sizes, association with scarce habitats, and impacts of previous management. The Survey and Manage Standards and Guidelines were added to help mitigate these concerns. It is expected that, at least in the case of some species added because of uncertainty, strategic surveys and other information sources will indicate Survey and Manage is not needed and species will be removed. Other, rare, species could remain on Survey and Manage.

The provision for adding species in the action alternatives uses basically the same process and concern for persistence criteria that are used to remove species from Survey and Manage. Information indicating species should be added in the future could come from a variety of sources including: (1) newly discovered and classified species; (2) new species resulting from taxonomic revisions; (3) species recently determined to be late-successional forest associated; or (4) species

recently found within the Northwest Forest Plan area. Species to be added could also include species already considered in the Northwest Forest Plan or previously removed from Survey and Manage and discovered through monitoring or other sources to be more at risk than originally believed. “Other sources” of information could include (but are not limited to) the public or academia, the Oregon Natural Heritage Program, or the Agencies’ special status species programs.

## **Environmental Consequences and Comparison of Alternatives**

The number of future species additions is unknown. Anecdotal evidence indicates there may be from 5 to 40 species in the existing taxa groups, currently available to be proposed for addition. The provision to add species in the action alternatives provides an opportunity to provide management for species not originally included in the Northwest Forest Plan and for which there is questions as to whether the reserves and other standards and guidelines provide a reasonable assurance of persistence.

For the three action alternatives, if “new” species are to be added, information regarding species occurrence in the Northwest Forest Plan area and late-successional forest association must come from scientifically credible sources such as academia, discovery during other surveys, public input, professional interest, and publications. Since the criteria require published taxonomic entities and evidence of late-successional association, it may be reasonable to expect that, for some of these species, there will be evidence upon which to base a concern for persistence. In the absence of evidence indicating other elements of the Northwest Forest Plan provide for persistence, species would be added to Survey and Manage. On the one hand this might result in species being added for no reason other than lack of information, and subsequent surveys and analysis could indicate they should be removed. For these species, the addition to Survey and Manage will turn out to be an unnecessary expense. On the other hand, the provision will also result in the timely addition of species that are truly rare and would benefit from Survey and Manage or some similar measure. For these species, the provision to add species will help provide a reasonable assurance of persistence.

The No-Action Alternative could put some future endemic species at risk, while the action alternatives remove this risk but have the monetary cost of conducting strategic surveys for some species that will eventually be removed.

The effects for Alternative 2 are somewhat different from Alternatives 1 and 3, in the same way that the alternatives are already contrasted in the species effects sections for uncommon species. With the uncommon category unavailable for new species in Alternative 2, species must meet a somewhat higher threshold of concern before being added to Survey and Manage. There could be a slightly higher risk for these species because occupied sites are more likely to be adversely affected by management activities before they are added. However, since species would be added when they meet the rare concern for persistence criteria, it is expected that species would be added before this risk becomes high.

## **Species Associated With Early-Successional Forest**

### **Background and Affected Environment**

The Northwest Forest Plan was developed to address federal land management issues related to late-successional forest associated species. Despite this emphasis, it was necessary for the Final SEIS to analyze expected effects of the alternatives on early-successional associated species (USDA, USDI 1994a, pp. 3&4-203 through 205). The Northwest Forest Plan Final SEIS describes the broad ecological characteristics of early-successional forest associated species and offers general conclusions about the abundance and distribution of early-successional forest prior to the influences of timber harvest and other modern land management practices. Those descriptions provide the basis for conclusions regarding effects on early-successional forest associated species from the alternatives in the Northwest Forest Plan Final SEIS.

Alternative 9 of the Northwest Forest Plan Final SEIS (the selected alternative) was found acceptable for sustaining adequate populations of species dependent upon young forest habitat. These conclusions were based on several interacting factors: (1) the large acreage in early-successional condition across federally managed lands at the time of the analysis (1994); (2) the expectation that future timber harvest under all the alternatives would create more early-successional habitat, offsetting the regrowth of stands in previously harvested acreage; (3) the ecological characteristics of early-successional forest associated species, which generally include higher mobility/dispersal capability to move from one early-successional patch to another as succession occurs; (4) timber harvest on nonfederal lands and natural disturbances which would continue to create early-successional habitat across the Northwest Forest Plan area; and, (5) the knowledge that individual National Forest and BLM District land and resource management plans would continue to address the needs of early-successional forest associated species.

Early-successional forest associated species as a group are generally widespread and occur throughout the Northwest Forest Plan area. Individual species may be distributed in a smaller geographic range, and occur in a more limited area within that general geographic range. These species are adapted to a variety of habitats that are early seral in nature. These species are assumed to be stable within the planning area.

With federal timber harvest levels below those anticipated in the Northwest Forest Plan Record of Decision, there is a trend toward somewhat less early-successional habitat on Matrix lands than was expected in that analysis. However, the acreage of the anticipated timber harvest is a minor component of the total federal acreage. This is largely due to the preponderance of early-successional habitat already existing across the Northwest Forest Plan area relative to what would be expected in a natural forest ecosystem.

Historically, early-successional habitats were the result of relatively unpredictable and irregularly distributed natural disturbance processes. Whereas some patterns and locations of Native American fire use are generally understood, other fire patterns and ignition sources were likely more random and more temporally variable across the planning area. While the total acreage of early-successional habitat in the planning area is likely to decline over the next few decades, an equilibrium is expected to be reached that is not likely to be substantially different than the range of natural variability on a landscape scale. While the actual location and amount of early-successional habitat available during Northwest Forest Plan implementation is unknown, the assumed availability on a landscape scale of early-successional habitat is unlikely to substantially differ from that occurring under historic natural disturbance processes. This assumption has been described in more detail in the Wildland and Prescribed Fire section, and in Figure 3&4-3, presented earlier in this Chapter.

## **Environmental Consequences and Comparison of Alternatives**

The primary future sources of early-successional habitats in the Northwest Forest Plan area are timber harvest and natural disturbance processes. Timber harvest that would likely result in early-successional habitat (i.e., regeneration harvest) would occur primarily on Matrix and Adaptive Management Areas (on federally managed lands), and on nonfederal lands adjacent to the planning area. Natural disturbance processes (such as wildfire and wind events) will likely occur on both federally managed and nonfederal lands.

The alternatives vary in the actual acreage of early-successional forest likely to be available over time. All of the action alternatives would result in removing 63 species, plus 9 species for part of their range, from protection under the Survey and Manage Standards and Guidelines. Removal of these species would result in approximately 24,800 acres of existing managed known sites being returned to the underlying Matrix or Adaptive Management Area land allocation and potentially available for timber harvest.

Based on future projections (see Timber Harvest section in this chapter), approximately 483,000 acres would be included in Survey and Manage species known site management under the No-Action Alternative, and would not contribute to long-term availability of early-successional habitats. Under the No-Action Alternative, none of the 72 species would be removed in all or part of their ranges, and known sites for these species would continue to be managed. In large part, these 483,000 acres result from estimates, based on projections of past surveys, for managing current and future known site locations throughout these species' ranges.

Alternatives 1 and 2 are projected to provide more acres of early-successional forest over time, compared to the No-Action Alternative, because these alternatives would manage known sites for Survey and Manage species on only 81,000 and 61,000 acres, respectively. Since 72 species are removed from Survey and Manage in all or part of their ranges under all action alternatives, acres associated with known sites of these species are returned to the underlying land allocation and are potentially available for harvest, resulting in initiation of early-successional habitats.

In contrast to Alternatives 1 and 2, but similar to the No-Action Alternative, Alternative 3 would manage about 570,000 acres of habitat (much of it late-successional forest) under known site management, which would result in a reduction in the availability of early-successional habitats over time. Most of the increase in acreage of managed known sites under Alternative 3 is attributable to the requirement to manage each known site with a 250-meter buffer. Thus, each species or species group location would result in a minimum of 48 acres included in known site management for late-successional conditions, and would be generally unavailable for production of habitat for early-successional forest associated species.

Natural disturbance is the other primary source of early-successional habitats. Across the range of the Northwest Forest Plan, these events are most likely to be the result of wildfire and wind events. The effects of these disturbances depends to some degree on past fire suppression, forest composition, seral stage, and structural conditions of the stands affected. The frequency and effects of these processes, while locally somewhat more predictable, are subject to great variability over the broad, diverse area covered by the Northwest Forest Plan. Actual effects of wind and fire of stand-replacement severity, and resultant initiation of early-successional conditions, is highly variable and relatively unpredictable across the planning area. These disturbance events are not a planned management objective, but rather are phenomena that affect future management. For purposes of this analysis, the Agencies assume that the acreage of early-successional forest initiated through natural disturbance events does not vary substantially among the alternatives.

The adaptive management component of the action alternatives leads to uncertainty as to its effect on other land management programs and environmental conditions due to the potential for changes in the Survey and Manage species and, therefore, changes in the number of acres affected. The No-Action Alternative is somewhat static in the number of species that would be retained on Survey and Manage, though it is possible that species could be removed. Even so, future surveys for the species covered under the No-Action Alternative will result in new locations and additional acres identified for the species management. Alternatives 1, 2, and 3 allow both deletions and additions to Survey and Manage, which exacerbates the uncertainty in the acres affected. With any of these alternatives, the impacts of the fluctuating list of species and the corresponding fluctuation in acreage protection for those species, along with the location of new species sites, adds uncertainty to estimates of the future effects of the alternatives.

Despite this uncertainty, the impacts associated with the four alternatives in this SEIS would not result in changes to the abundance and distribution of species associated with early-successional habitat that was not anticipated in the Northwest Forest Plan Final SEIS. This is due to the large extent of early-successional habitat currently available, and the reasonable expectation that federally managed and nonfederal lands will continue to be harvested and natural disturbances will continue throughout the Northwest Forest Plan area. Therefore, the four alternatives would have little effect on populations of early-successional forest associated species. Early-successional forest associated species are expected to remain stable and distributed in a pattern similar to their historic distribution within the planning area.

For these reasons, all alternatives would provide adequate acreage and distribution of early-successional habitat across the planning area adequate to sustain populations of species dependent on young forest habitat. Although local populations of early-successional forest associated species would vary in number and distribution over time, these generally mobile and highly productive species are adapted to colonizing new habitats as they become available across their range, and are expected to be relatively stable and widely distributed across the Northwest Forest Plan area under all alternatives.

## Threatened and Endangered Species

This section discusses the potential effects to species listed as threatened or endangered, or proposed for listing, under the Endangered Species Act of 1973, as amended. A complete list of these species can be found in the Biological Evaluation in Appendix G of this document. This section discusses in detail those listed species that are associated with late-successional forests in the Northwest Forest Plan area (i.e. the action area). A complete description of effects to all listed species in the planning area can be found in Appendix G.

### Northern Spotted Owl (*Strix occidentalis caurina*)

#### Background and Affected Environment

Management of northern spotted owls and their habitat on federally managed lands was an important consideration in the design of the Northwest Forest Plan. This species received extensive attention in the Northwest Forest Plan Final SEIS and its supporting documents. The Northwest Forest Plan Final SEIS (USDA, USDI 1994a, pp. 3&4-211 through 245 and Appendices G, J1, and J3) provides the basis for concluding that the Northwest Forest Plan would serve as the Agencies' contribution to spotted owl recovery.

An April 12, 1994, letter from the Northwest Forest Plan Final SEIS Team Leader to the U.S. Fish and Wildlife Service specifically addressed the contribution to spotted owl habitat which would accrue from implementation of the Survey and Manage Standards and Guidelines. This discussion states that the expected small scale of late-successional forest areas that would be retained for the Survey and Manage Standards and Guidelines would have a negligible beneficial effect on the maintenance of spotted owl populations. This negligible effect results from the fact that the federal spotted owl population recovery strategy is primarily designed to retain and manage large blocks of late-successional habitat to provide for population clusters of spotted owl pairs (Biological Assessment of the Draft SEIS, October 1993). Most Survey and Manage sites are small in comparison.

An additional component of the Northwest Forest Plan spotted owl strategy was assurance of successful spotted owl dispersal among the large reserves through their relatively close proximity. The distance between the large reserves is generally closer than what is needed, based on population modeling, to provide for adequate dispersal between these reserves. The retention and restoration of late-successional forest in Riparian Reserves and the 100-acre owl activity centers would contribute to spotted owl dispersal by providing foraging and roosting habitat for dispersing spotted owls. The additional late-successional forest retained to protect Survey and Manage species would provide a minor acreage contribution, when compared to the acreage of current and potential dispersal habitat in Riparian Reserves and 100-acre owl core areas, that might contribute to spotted owl movement across the landscape.

The Northwest Forest Plan Final SEIS anticipated that some Matrix and Adaptive Management Areas undergoing future timber harvest would be suitable spotted owl habitat and would be occupied by spotted owls (Appendix J3 in USDA, USDI 1994a, p. J3-8). Therefore, the anticipated rate of timber harvest in the Matrix and Adaptive Management Areas was included as part of the analysis of effects to spotted owls in the Northwest Forest Plan Final SEIS. The

Northwest Forest Plan Final SEIS analysis concluded that the expected timber harvest would be compatible with spotted owl habitat management objectives. The loss of spotted owl habitat in the Matrix and Adaptive Management Areas was anticipated to occur in a manner which would allow the habitat to regrow and spotted owl populations to stabilize in the Late-Successional Reserves and Congressionally Reserved Areas.

The management direction for spotted owl habitat contained in the Northwest Forest Plan is based on providing large blocks of late-successional forest in Congressionally Reserved Areas and Late-Successional Reserves. Also, Riparian Reserves and other standards and guidelines would provide for dispersal between the reserves in lieu of special species-specific provisions. Management of the Congressionally Reserved Areas and Late-Successional Reserves has occurred consistent with what was anticipated in the Northwest Forest Plan Final SEIS. The most common activities inside Late-Successional Reserves are silvicultural thinning of non-late-successional stands to improve spotted owl habitat, and risk management (fuels reduction) in the drier forest types. After 6 years of implementing the Northwest Forest Plan, there have been fewer impacts to the spotted owl population in Matrix and Adaptive Management Areas than were originally anticipated due to lower than anticipated timber harvest, and the designation of more Riparian Reserve acreage than originally modeled. This has resulted in somewhat lower than expected impacts to the species than originally anticipated.

A recent meta-analysis conducted on all 16 spotted owl demographic study areas in Oregon, Washington, and northern California indicates that female survival rates and reproductive rates were not declining over time (Franklin et al. 1999). This result is based on many different studies from throughout the range of the northern spotted owl. The estimated rate of decline in the 1998 meta-analysis of spotted owl data was 3.9 percent, with a 95 percent confidence interval of 0.925 - 0.997. This means that the population could be declining by as much as 7.5 percent per year, or by as little as 0.3 percent per year. Based on the fact that most demographic studies are not reporting large declines in owl numbers, the actual rate of decline may be closer to 0.3 percent per year than it is to 7.5 percent per year (Forsman, pers. comm.).

After 6 years, these scientific findings indicate that the original spotted owl management strategy is being met. The 1999 results indicate a slightly slower decline in the spotted owl population and a stabilization of the female survival rates (Forsman, pers. comm.), when compared to a similar analysis from 1993 (Forsman et al. 1996) that was considered in the Northwest Forest Plan Final SEIS. These conclusions are consistent with projections from that analysis.

Critical habitat for the northern spotted owl was designated on January 15, 1992 (57 FR 1796). Federal agencies have continued to manage spotted owl critical habitat in compliance with the Endangered Species Act, consulting on activities that may affect critical habitat. The Northwest Forest Plan Final SEIS did not attribute any specific contribution of Survey and Manage known sites to critical habitat for the spotted owl. Any activity proposed within spotted owl critical habitat would be analyzed based on its impacts to this habitat, regardless of any Survey and Manage species.

The Northwest Forest Plan Final SEIS anticipated publication of a special rule for spotted owls under section 4(d) of the Endangered Species Act (USDA, USDI 1994a, pp. 3&4-8 through 3&4-10). This rule has not been completed at this time. This rule would have released some nonfederal lands in portions of the spotted owl range in Washington from the prohibition against harming ("take" of) spotted owls. Many Habitat Conservation Plans (provided for under section 10(a)(1)(B) of the Act) have been completed. These plans result in permits for the incidental take of spotted owls for nonfederal activities when conducted in compliance with those plans. All Habitat Conservation Plans having undergone consultation relative to spotted owls under Section 7 of the Endangered Species Act were judged to not appreciably reduce the survival and recovery of the spotted owl in the wild. These plans have an effect similar to the proposed 4(d) rule by allowing some potential loss of spotted owls on nonfederal lands, and their effect is consistent with the assumptions of the Northwest Forest Plan Final SEIS.

## Environmental Consequences and Comparison of Alternatives

The four alternatives would have similar effects on spotted owl habitat management across the Northwest Forest Plan area. Large reserves and other components of the Northwest Forest Plan would continue to provide habitat blocks for population clusters and dispersal conditions for individual spotted owls under all of the alternatives.

The primary potential effects of Alternatives 1, 2, and 3 on spotted owls would result from removing protection for 63 Survey and Manage and Protection Buffer species and reduction in the area where the Survey and Manage Standards and Guidelines apply for 9 additional species. The primary difference between the three action alternatives and the No-Action Alternative would be the loss of protection (due to removing 72 Survey and Manage species in all or part of their range) for approximately 24,800 acres of late-successional habitat (scattered in small patches) across the Northwest Forest Plan area. This may be a slight overestimation of the number of acres undergoing a loss of protection since the presence of other Survey and Manage species at the same location could result in continued protection at some of these sites.

The acreage of protected habitat for Survey and Manage species, though meaningful for the individual Survey and Manage species, occurs as scattered, relatively small patches which provide little contribution to the maintenance of spotted owl populations. These small patches often could not be considered “suitable” habitat for spotted owls unless they happen to be contiguous with other reserved habitat (such as adjacent to an existing 100-acre owl core area) or part of a block of habitat large enough to support spotted owl use. The analysis of spotted owl habitat and effects of the Northwest Forest Plan on that habitat considered the potential contribution of small patches of late-successional forest identified for Survey and Manage and Protection Buffer species. At that time, the acreage of late-successional forest that would be included in managed known sites and protection buffers was assumed to be very low, and their distribution across the landscape and location relative to reserves or listed species sites were unpredictable. For those reasons, that analysis concluded that these small areas of late-successional forest would not provide significant benefits to listed species. The conclusions regarding the effects to the Northwest Forest Plan on spotted owls thus did not rely on any assumed benefit to spotted owl from the Survey and Manage Standards and Guidelines.

Although 72 species would be removed from Survey and Manage over all or part of their ranges under the action alternatives, the patches of late-successional forest that would be returned to underlying land allocations and potentially available for timber harvest would not lower the amount or change the distribution of habitat available to spotted owls, since the acres for all Survey and Manage known sites and Protection Buffers were not anticipated to contribute significant benefits to owls in the analysis of the Northwest Forest Plan Final SEIS. While these areas may benefit dispersing spotted owls by providing additional structure and habitat complexity to the harvested area through the next stand rotation, any effects are negligible when compared to the contribution of Riparian Reserves and the other Matrix Standards and Guidelines.

One difference between the alternatives is the effect on the red tree vole (*Arborimus longicaudus*). The red tree vole is an important prey species of the spotted owl. The contribution of red tree voles as prey varies in different portions of the range of the northern spotted owl, from a low of 1 percent (of total prey items) of the diet to a high of 6 percent. However, in some circumstances, red tree voles may represent a higher proportion of the diet of individual spotted owls. In coastal southwestern Oregon, the vole made up 50 percent of the prey items consumed by two owl pairs, though due to their small size, red tree voles provided only 16 percent of the total biomass of the diet (Forsman et al. 1984).

Alternative 2 would substantially increase the risk that Oregon red tree vole populations may decline throughout portions of the species range and that the remaining populations could become more isolated (see Red Tree Vole discussion in this chapter) compared to Alternatives 1 and 3 and the No-Action Alternative. This increased risk would result from management activities that occur primarily in the Matrix and Adaptive Management Areas. Any effects on spotted owls would be



greatest for resident spotted owls because they are dependent on prey availability within their individual home range. However, because red tree voles do not represent a large portion of the diet of most resident spotted owls and the Matrix and Adaptive Management Areas are not expected to provide long-term habitat for resident spotted owls, any effect to spotted owls from reductions of red tree vole populations is likely to be low.

The three action alternatives contain adaptive management components that result in some uncertainty as to their effect on other land management programs and environmental conditions. This uncertainty is due to the potential for changes in the Survey and Manage species and changes in the number of acres affected. The No-Action Alternative is assumed for analytical purposes to be somewhat static in the number of species it would retain on Survey and Manage, though it is possible that species could be removed. Even so, future surveys for the species covered under the No-Action Alternative would result in new locations and additional acres identified for the species management. Alternatives 1, 2, and 3 provide for both deletions and additions to Survey and Manage, which exacerbates the uncertainty in the number of acres affected. With any of these action alternatives, the impacts of the changing list of species and the corresponding fluctuation in acreage protection for those species, along with the location of new species sites, adds uncertainty to the estimate of the future effects of the alternatives. Nevertheless, because of the inconsequential amount of habitat for spotted owls provided by the Survey and Manage and Protection Buffer Standards and Guidelines, there is sufficient information on which to base a reasonable analysis and conclusion.

Neither the No-Action Alternative nor any of the three action alternatives will affect the original basis for the assessment or the conclusions of the effects to spotted owls as presented in the Northwest Forest Plan Final SEIS. Congressionally Reserved Areas and Late-Successional Reserves will continue to be managed for late-successional habitat in the Northwest Forest Plan area and provide for spotted owl breeding clusters. Distances between the Congressionally Reserved Areas, Late-Successional Reserves, and Riparian Reserves will continue to provide for dispersal of spotted owls. The potential difference between alternatives has no effect on the spotted owl habitat management strategy because it results in only negligible fluctuations in the amount of habitat. The Northwest Forest Plan Final SEIS assumptions and conclusions relative to a spotted owl 4(d) rule and critical habitat remain valid as described above. Therefore, none of the alternatives in this SEIS would affect the conclusions that spotted owls will be adequately provided for under the Northwest Forest Plan.

## **Marbled Murrelet (*Brachyramphus marmorata*)**

### **Background and Affected Environment**

Management of marbled murrelet habitat on federally managed lands was an important component in the design of the Northwest Forest Plan. This species received extensive attention in the Northwest Forest Plan Final SEIS and its supporting documents. The Northwest Forest Plan Final SEIS (USDA, USDI 1994a, pp. 3&4-245 through 249, and Appendices G and J2) provides a detailed explanation of the basis for concluding that the Northwest Forest Plan would serve as the Agencies' contribution to marbled murrelet recovery. Additional information was provided in the April 12, 1994, letter from the Final SEIS Team Leader to the U.S. Fish and Wildlife Service.

The management strategy for marbled murrelets in the Northwest Forest Plan includes two primary components: (1) protection and development of marbled murrelet nesting habitat inside the large reserves near the coast; and, (2) retention of all current and future known marbled murrelet nest sites in all land allocations and protecting occupied habitat. Location of murrelet nest sites is ensured by requiring surveys of potential marbled murrelet habitat prior to management activities.

Management of the Congressionally Withdrawn Areas and Late-Successional Reserves has occurred as expected. The most common activity in the coastal areas is the silvicultural thinning

of stands within Late-Successional Reserves to encourage late-successional forest development. After 6 years of implementing the Northwest Forest Plan, there have been fewer impacts to the late-successional forest in the Matrix and Adaptive Management Areas than was originally expected due to lower than anticipated timber harvest and more Riparian Reserve acreage than originally modeled.

Because the pre-disturbance survey requirements for potential marbled murrelet habitat prevent the inadvertent loss of occupied sites, there is no anticipated effect from the Survey and Manage and Protection Buffer Standards and Guidelines. Therefore, there is no new information that would substantially alter the conclusions of the Northwest Forest Plan Final SEIS concerning marbled murrelets.

### **Environmental Consequences and Comparison of Alternatives**

The four alternatives would have similar effects on marbled murrelet habitat management. The primary potential effect of Alternatives 1, 2, and 3 on marbled murrelets would result from removing protection for 63 Survey and Manage and Protection Buffer species and reduction in the area where the Survey and Manage Standards and Guidelines apply for 9 species. This difference between the three action alternatives and the No-Action Alternative would be the loss of protection for an estimated 24,800 acres of late-successional habitat across the Northwest Forest Plan area, much of this is outside the range of the marbled murrelet. However, the presence of other Survey and Manage species at the same location could result in continued protection at some of these sites. Despite removing management of these Survey and Manage sites, the level of protection for currently occupied marbled murrelet habitat would not be reduced, since marbled murrelet surveys and habitat protection measures would remain in place regardless of Survey and Manage Standards and Guidelines. All nest sites located would be protected under existing Northwest Forest Plan Standards and Guidelines for the murrelet.

## **Bald Eagle (*Haliaeetus leucocephalus*)**

### **Background and Affected Environment**

Breeding and wintering populations of the bald eagle occur throughout the Northwest Forest Plan area and are addressed in the Pacific States Bald Eagle Recovery Plan and the Oregon-Washington Bald Eagle Working Team Implementation Plan. Agencies survey extensively for bald eagles. Management of the bald eagle includes preparation of site-specific management plans and providing protection zones and management areas, as needed, to the species and its habitat. Management guidelines delineated in these plans address the potential loss of habitat from timber harvest activities, the distribution goals identified in the recovery plan, and to some extent, human disturbance.

### **Environmental Consequences and Comparison of Alternatives**

All four alternatives would have similar effects on bald eagle habitat management. The primary potential effect of Alternatives 1, 2, and 3 on bald eagles, would result from removing protection for 63 Survey and Manage and Protection Buffer species and reduction in the area where the Survey and Manage Standards and Guidelines apply for 9 species. This difference between the action alternatives and the No-Action Alternative, would be the loss of protection for an estimated 24,800 acres of late-successional habitat across the Northwest Forest Plan area. The current requirements to conduct specific surveys and develop site management plans for bald eagles greatly reduces any potential effect from changes in the Protection Buffer and Survey and Manage Standards and Guidelines. None of the alternatives will affect the original basis for the assessment of the effects and conclusions in the Northwest Forest Plan Final SEIS.

## Canada Lynx (*Lynx canadensis*)

**Note to the Reader:** Effective April 24, 2000, the Canada lynx was listed by the U.S. Fish and Wildlife Service as a threatened species within its range in the conterminous 48 United States. Due to its change in status under Endangered Species Act, and consequently within this SEIS, the analysis of the Canada lynx background, affected environment, environmental consequences, and comparison of alternatives has been moved from the Late-Successional Mammal section of Chapter 3&4 in the Draft SEIS to the Threatened and Endangered Species section.

### Background and Affected Environment

Under the Northwest Forest Plan ROD, the Canada lynx was a Protection Buffer species. At that time, the standard and guideline required surveys prior to ground-disturbing activities. Management direction for the lynx was changed on June 11, 1996, from requiring pre-disturbance surveys to an extensive survey approach. This change reflected new information and understanding of species management needs since the signing of Northwest Forest Plan ROD. This approach more appropriately addressed the primary survey need for the lynx: to better define its range in the Northwest Forest Plan area. Under the Northwest Forest Plan, this direction applied within the Matrix land allocation.

As a result of that change in management direction, biologists have conducted extensive surveys, and lynx occurrences have been documented in areas where they were not known to occur at the time of the Northwest Forest Plan Final SEIS. In the Northwest Forest Plan Final SEIS, lynx information indicated the species occurred only in the north-central portion of the Cascade Range in Washington. The newly documented lynx distribution that includes recent information extends the likely range of the lynx in the Northwest Forest Plan area to the remainder of the higher elevation forests in the Washington Cascades and some of the Oregon Cascades. Surveys continue to be conducted with the objective of clarifying the appropriate geographic area for management of lynx habitat.

Under the Draft SEIS, all three action alternatives proposed a broader application of the Protection Buffer language that currently applies to only Matrix and Adaptive Management Areas (USDA, USDI 1994a pp. C-47 through 48) to all land allocations, and proposed to remove the species from the Survey and Manage designation. Extensive regional surveys would continue to be the source of data to determine the range and habitat use of the species. Also under the Draft SEIS, the action alternatives proposed development of site-specific timber harvest, roading, and fire management plans in the known lynx range, regardless of land allocation. The action alternatives, as then designed, would have improved the lynx habitat management strategy because the management requirements would be applied to all potential habitat on lands managed by the Forest Service and BLM, rather than just Matrix and Adaptive Management Areas. Extensive surveys would continue to be conducted and habitat management guidance and direction would be developed for the lynx in all three action alternatives. This management direction would be the interim Management Recommendation until or unless a Management Recommendation was completed, or a national interagency Canada Lynx Conservation Assessment and Strategy was developed. The action alternatives, as described in the Draft SEIS, would encourage the adoption of new information, which should result in improved habitat management for this species. This would allow adoption of more up-to-date species and habitat information, which may differ from the standards in the original Protection Buffer Standards and Guidelines.

At the time of the release of the Draft SEIS on December 3, 1999, the Canada lynx was proposed for listing as threatened under the Endangered Species Act (ESA). Subsequently, the Canada lynx was listed as a threatened species (65 FR 16052), effective April 24, 2000. The U.S. Fish and Wildlife Service concluded that the population in the conterminous United States was threatened by human alteration of forests, low numbers as a result of past overexploitation, expansion of the range of competitors, and elevated levels of human access into lynx habitat. Concurrent with the listing process, a national interagency Lynx Conservation Assessment and Strategy was developed

to provide a consistent and effective approach to conservation of Canada lynx on federally managed land in the conterminous United States. The Forest Service, BLM, U.S. Fish and Wildlife Service, and National Park Service were the lead Federal agencies in the preparation of the range-wide Lynx Conservation Assessment and Strategy.

The Lynx Conservation Assessment and Strategy identifies 17 risk factors in 4 different categories: factors affecting lynx productivity, lynx mortality, lynx movements, and other large-scale risk factors. Risk factors identify activities or existing conditions that could adversely affect either individual or groups of lynx. Factors identified include timber management; wildland fire management; recreation; forest/backcountry roads and trails; livestock grazing; other human developments; trapping; predator control; incidental or illegal shooting; competition and predation as influenced by human activities; highways (vehicular collisions); highway, railroad, and utility corridors; land ownership patterns; ski areas and large resorts; fragmentation and degradation of lynx refugia; lynx movement and dispersal across shrub-steppe habitats; and habitat degradation by non-native invasive plant species. Within the Northwest Forest Plan area, the primary risk factors for lynx are forest type conversion and precommercial thinning in snowshoe hare habitat (primary lynx prey); fire exclusion that prevents natural disturbance processes; roads and winter recreational trails; and lack of a lynx monitoring strategy.

On February 7, 2000, the Forest Service and the U.S. Fish and Wildlife Service entered into a conservation agreement. The Forest Service agreed to consider conservation measures in the Lynx Conservation Assessment and Strategy when designing and implementing activities that might affect lynx. This agreement applies to Forest Service-managed lands in Regions 1, 2, 4, 6, and 9, and was signed in coordination with Regions 1, 3, 5, and 6 of the U.S. Fish and Wildlife Service. This agreement applies to all National Forest System lands that provide known or potential lynx habitat in the Northwest Forest Plan area, as described in the Lynx Conservation Assessment and Strategy.

Under this agreement, the Forest Service and U.S. Fish and Wildlife Service recognize the Lynx Conservation Assessment and Strategy (and the science report upon which it is based) as a detailed summary of current scientific knowledge about the Canada lynx, and agree to use the Lynx Conservation Assessment and Strategy in making determinations of effects for actions potentially affecting lynx or lynx habitat. They also agree to review and consider the Lynx Conservation Assessment and Strategy in designing activities so as to avoid adverse impacts to the species.

The Canada Lynx Standard and Guideline in this SEIS would require the Agencies to follow the existing conservation agreements, and consider conservation measures in the Lynx Conservation Assessment and Strategy, when designing and implementing actions that could affect lynx or their habitat. This standard and guideline would apply to all land allocations.

The BLM has recently reviewed its evaluations of potential suitable lynx habitat on lands it administers within the species suspected range in the planning area. Based upon criteria for identifying and mapping suitable habitat as recommended by the Lynx Science Team, this recent review has concluded that no suitable lynx habitat occurs on BLM administered lands in the planning area.

The Salem, Eugene, Coos Bay, Roseburg, and Medford BLM Districts, and the Klamath Falls Resource Area of the Lakeview District, have evaluated lynx habitat on BLM administered lands in western Oregon. Earlier evaluations had indicated the potential for the occurrence of secondary habitat on a small portion of the Salem District; all other Districts indicated that they contained no lynx habitat. The current review of these previous evaluations were conducted using the July 28, 2000, Criteria and Procedures for Lynx Habitat Mapping and Recommendations for Oregon and Washington from the Lynx Biology Team. Based on this recent review, the BLM concludes that there is no lynx habitat on the BLM administered lands in the planning area. This conclusion is based upon the following determinations made by BLM wildlife biologists using the information and criteria recommended from the Lynx Biology Team.

1. In the western United States, lynx generally occur above the 4,000 foot elevation level. Nearly all of the BLM administered lands in the planning area are below 4,000 feet in elevation.
2. For those BLM administered lands above 4,000 feet in elevation, there is no occurrence of mesic subalpine forest, considered to be the primary habitat for the lynx.
3. For those BLM administered lands above 4,000 feet in elevation, and that include the Pacific silver fir/mountain hemlock subtype (potential secondary habitat), these forest stands are not intermingled with or immediately adjacent to subalpine forest (considered to be the primary habitat). Thus, they do not qualify for consideration as secondary habitat. Additionally, the Lynx Biology Team stated “There is little evidence to suggest that the silverfir/hemlock subtype actually supports lynx.”

Based on these considerations, the Agencies conclude that no Canada lynx habitat occurs on BLM administered lands within these Districts/Resource Areas in western Oregon, and that actions administered by the BLM in western Oregon are not likely to impact lynx in the subject area.

The Lynx Conservation Assessment and Strategy and the U.S. Fish and Wildlife Service’s listing process documents (proposed and final rule) are sources of more complete descriptions of the status and distribution of this species. The Lynx Conservation Assessment and Strategy and other pertinent documents containing information on the Canada lynx (including the Forest Service/U.S. Fish and Wildlife Service Canada Lynx Conservation Agreement) can be located and downloaded from the web at [www.fs.fed.us/r1/planning/lynx/lynx.html](http://www.fs.fed.us/r1/planning/lynx/lynx.html). The U.S. Fish and Wildlife Service listing process documents may be located at [www.r6.fws.gov/endspp/lynx](http://www.r6.fws.gov/endspp/lynx).

### **Environmental Consequences and Comparison of Alternatives**

All four alternatives would continue to provide management guidance for the lynx, with the goal of providing adequate habitat and protection measures to maintain the species throughout its documented range in the Northwest Forest Plan area.

The No-Action Alternative would retain the lynx Protection Buffer language on pages C-47 through C-48 of the Northwest Forest Plan Record of Decision (USDA, USDI 1994b) that applies special management in the Matrix and Adaptive Manage Area land allocations. The REO issued a memorandum dated June 11, 1996, that documented the RIEC decision to change specific provisions regarding the management of lynx in the Standards and Guidelines of the Northwest Forest Plan. This decision changed the lynx to management under Component 3 rather than Component 2. Component 3 requires extensive surveys to identify high-priority areas for species management. The Protection Buffer Standards and Guidelines on pages C-47 and C-48 remained unchanged. As a wide-ranging species, effective management of its habitat is more appropriately applied across all land allocations, rather than restricted to Matrix and Adaptive Management Area.

Continuing the current direction, in the absence of the conservation agreement, that applies primarily on Matrix and Adaptive Management Area land allocations, would be ineffective in meeting the species needs by focusing on only part of the landscape rather than analyzing conditions and capabilities across all land allocations. However, through implementation of the conservation agreement, provisions in the Lynx Conservation Strategy and Assessment would be fully considered. Thus, although activities designed solely in compliance with management direction in the No-Action Alternative may have significant adverse effects to lynx, provisions in the recent conservation agreement ensure that activities conducted by the Forest Service in the interim would provide appropriate conservation measures for the lynx.

Since all three action alternative propose to apply the same management direction and Canada Lynx Standard and Guideline, the environmental consequences of these alternatives would be identical. Under the action alternatives, the Agencies would not propose or conduct any activity

that would result in a “likely to adversely affect” effect determination for the lynx until land and resource management plans were reviewed or amended, as appropriate, to fully consider conservation measures from the Lynx Conservation Assessment and Strategy. This amendment process would include appropriate NEPA review and public involvement, and compliance with provisions of the Endangered Species Act. For activities on Agency lands proposed by third parties (or involve third parties), the Agencies would review and consider the new information on lynx to ensure compliance with all applicable federal laws, including the Endangered Species Act and National Environmental Policy Act, during the analysis and decision-making process. This would include a consideration of cumulative effects and a determination that the action would not result in an irreversible and irretrievable commitment of resources that would foreclose reasonable and prudent alternatives under section 7(d) of Endangered Species Act. For these reasons, the Canada Lynx Standard and Guideline, as proposed under the three action alternatives, is expected to result in a very low risk to lynx within the planning area.

Other modifications to the Northwest Forest Plan proposed in this SEIS are also expected to have little effect on the lynx in the planning area. Extensive surveys for lynx (as described under the No-Action Alternative) are not required under the proposed standard and guideline for the action alternatives. However, similar surveys may be conducted under a national field sampling survey (Lynx Conservation Assessment and Strategy, p. 103), where the intent is to assess the present distribution of lynx populations and lynx habitat and further refine the understanding of lynx distribution and occurrence at various scales. Under this national field sampling survey, detection of lynx presence would be emphasized in some geographic areas, including the Oregon Cascades. Based on this information, implementation of any of the action alternatives would result in some change of survey requirements, but national field sampling surveys may acquire information of similar intent, scope, and priority to extensive field surveys. Regardless, protection of lynx under the action alternatives would be provided throughout their known and suspected range in the planning area through implementation of provisions of the conservation agreement; these measures are not contingent upon the completion of extensive surveys. Therefore, this change to requirements to conduct extensive surveys does not represent a significant adverse effect to the species under the action alternatives, and does not represent an increased risk to the species in the planning area.

Under the action alternatives, 72 species would be removed from Survey and Manage in all or part of their range in the Northwest Forest Plan area, resulting in approximately 24,800 acres of known sites being returned to the underlying land allocation. This is not expected to have a measurable effect on the lynx. Any decision to return these sites to the underlying land allocation, in and of itself, would not affect the habitat on the site. Future activities including, but not limited to, timber harvest, road construction, or application of prescribed fire, that might be proposed on these sites would be evaluated for their direct and indirect effects on lynx. Since management direction provided through the Canada Lynx Standard and Guideline would require that activities be not likely to adversely affect the species, future management at these sites would not result in adverse impacts to lynx.

Other changes to Northwest Forest Plan Standards and Guidelines, including those for bats, cavity nesting birds, and other provisions proposed in the action alternatives are not expected to have a measurable effect on the Canada lynx.

In summary, the action alternatives are likely to provide a slightly more effective management strategy than the No-Action Alternative to maintain the persistence of the Canada lynx in the planning area. Under the action alternatives, the Agencies would not conduct activities that are likely to adversely affect the lynx, unless land and resource management plans undergo additional National Environmental Policy Act and Endangered Species Act review, including public review and comment, as part of future plan revisions and amendments. The No-Action Alternative would continue to require extensive surveys for the species, but these surveys are not precluded by adoption of any of the action alternatives. The No-Action alternative would provide some measures to manage and protect the species, and the existing conservation agreement would provide for a full consideration of the Lynx Conservation Assessment and Strategy in activity

planning. However, the provisions of the conservation agreement are considered to be somewhat more flexible under the No-Action Alternative since full consideration of the Lynx Conservation Assessment and Strategy is not an explicitly stated provision of the lynx standard and guideline, as it is under all three action alternatives. For this reason, the No-Action Alternative may result in a level of risk to the species slightly higher than the action alternatives. However, under all alternatives, the lynx is anticipated to have stable populations in suitable habitat distributed in a pattern similar to its historic distribution in the planning area, due to requirements for consultation under the Endangered Species Act, and provisions included in the interagency conservation agreement and related documents.

## **Gray Wolf (*Canis lupus*)**

### **Background and Affected Environment**

The range of the gray wolf includes portions of the Northwest Forest Plan area, including the northern Cascade Range in Washington. Gray wolves are not closely associated with late-successional forest, but use a variety of open and forested habitat that support deer, elk and other species that are their primary prey, as well as areas supporting small mammal populations. Gray wolves are sensitive to human disturbance.

### **Environmental Consequences and Comparison of Alternatives**

All four alternatives would have nearly identical effects on gray wolf habitat. Because gray wolves are not dependent on late-successional forest, the small, isolated patches of late-successional forest that would be protected under the Survey and Manage Standards and Guidelines would have no effect on habitat for this species. None of the alternatives will affect the original basis for the assessment of the effects and conclusions in the Northwest Forest Plan Final SEIS.

## **Grizzly Bear (*Ursus arctos*)**

### **Background and Affected Environment**

The range of the threatened grizzly bear includes portions of the Northwest Forest Plan area, including the National Forests in the Cascade Range in Washington. While grizzly bears are not closely associated with late-successional forest, they use a variety of habitats, including forested areas for hiding and cover. Grizzly bears are sensitive to human disturbance.

### **Environmental Consequences and Comparison of Alternatives**

All four alternatives would have nearly identical effects on grizzly bear habitat. Because grizzly bears are not dependent on late-successional forest, the small, isolated patches of late-successional forest that would be protected under the Survey and Manage Standards and Guidelines would have no effect on habitat for this species. None of the alternatives will affect the original basis for the assessment of the effects and conclusions in the Northwest Forest Plan Final SEIS.

## **Other Species**

The following terrestrial or inland-aquatic listed species occur within the Northwest Forest Plan area, but are not associated with late-successional and old-growth forests. The Protection Buffer and Survey and Manage Standards and Guidelines were developed to address concerns for species associated with late-successional forest. Any habitat protected by the Protection Buffer and Survey and Manage Standards and Guidelines is likely to be late-successional conifer forest. Therefore, any changes to the Protection Buffer and Survey and Manage Standards and Guidelines should not affect these species or the conclusions of the Northwest Forest Plan Final SEIS.

## Vascular Plants

Sonoma alopecurus	<i>Alopecurus aequalis</i> var. <i>sonomensis</i>
MacDonald's rockcress	<i>Arabis macdonaldiana</i>
Marsh sandwort	<i>Arenaria paludicola</i>
Applegate's milkvetch	<i>Astragalus applegatei</i>
Clara Hunt's milkvetch	<i>Astragalus clarianus</i>
Tiburon paintbrush	<i>Castilleja affinis</i> ssp. <i>neglecta</i>
Golden Indian paintbrush	<i>Castilleja levisecta</i>
Howell's spineflower	<i>Chorizanthe howellii</i>
Sonoma spineflower	<i>Chorizanthe valida</i>
Baker's larkspur	<i>Delphinium bakeri</i>
Yellow larkspur	<i>Delphinium luteum</i>
Willamette daisy	<i>Erigeron decumbens</i> var. <i>decumbens</i>
Menzies' wallflower	<i>Erysimum menziesii</i>
Showy stickweed	<i>Horkelia venusta</i>
Gentner's mission-bells	<i>Fritillaria gentneri</i>
Marin dwarf-flax	<i>Hesperolinon congestum</i>
Water howellia	<i>Howellia aquatilis</i>
Beach layia	<i>Layia carnosa</i>
Burke's goldfields	<i>Lasthenia burkei</i>
Contra costa goldfields	<i>Lasthenia cojugens</i>
Western lily	<i>Lilium occidentale</i>
Bradshaw's lomatium	<i>Lomatium bradshawii</i>
Kincaid's lupine	<i>Lupinus sulphureus</i> var. <i>kincaidii</i>
Pt. Reyes clover lupine	<i>Lupinus tidestromii</i> var. <i>layneae</i>
Tidestrom's clover lupine	<i>Lupinus tidestromii</i> var. <i>tidestromii</i>
Many-flowered navarretia	<i>Navarretia leucocephala</i> ssp. <i>plieantha</i>
Slender Orcutt grass	<i>Orcuttia tenuis</i>
Yreka phlox	<i>Phlox hirsuta</i>
Hairy (Rough) popcorn flower	<i>Plagiobothrys hirtus</i>
Calistoga allocarya	<i>Plagiobothrys strictus</i>
Napa bluegrass	<i>Poa napensis</i>
Nelson's checkermallow	<i>Sidalcea nelsoniana</i>
Wenatchee Mountain checkermallow	<i>Sidalcea oregana</i> var. <i>calva</i>
Kenwood Marsh checkermallow	<i>Sidalcea oregana</i> var. <i>valida</i>
Ladies'-tresses	<i>Spiranthes diluvialis</i>
Kneeland Prairie penny-cress	<i>Thlaspi montanum</i> var. <i>californicum</i>
Showy Indian clover	<i>Trifolium amoenum</i>

## Invertebrates

Conservancy fairy shrimp	<i>Branchinecta conservatio</i>
Vernal pool fairy shrimp	<i>Branchinecta lynchi</i>
Valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>
Mission blue butterfly	<i>Icaricia icarioides missionensis</i>
Fender's blue butterfly	<i>Icaricia icarioides fenderi</i>
San Bruno elfin butterfly	<i>Incisalia mossii bayensis</i>
Vernal pool tadpole shrimp	<i>Lepidurus packardii</i>
Lotis blue butterfly	<i>Lycaeides argyrognomon lotis</i>
Shasta (placid) crayfish	<i>Pacifastacus fortis</i>
Callippe silverspot butterfly	<i>Speyeria callippe callippe</i>
Behren's silverspot butterfly	<i>Speyeria zerene behrensii</i>
Oregon silverspot butterfly	<i>Speyeria zerene hippolyta</i>
Myrtle's silverspot butterfly	<i>Speyeria zerene myrteleae</i>
California freshwater shrimp	<i>Syncaris pacifica</i>



**Fish**

Tidewater goby	<i>Eucyclogobius newberryi</i>
Delta smelt	<i>Hypomesus transpacificus</i>
Oregon chub	<i>Oregonichthys (Hybopsis) crameri</i>

**Birds**

Aleutian Canada goose	<i>Branta canadensis leucopareia</i>
Western snowy plover (coastal populations)	<i>Charadrius alexandrinus nivosus</i>
Brown pelican	<i>Pelcanus occidentalis</i>
California clapper rail	<i>Rallus longirostris obsoletus</i>

**Mammals**

Point Arena mountain beaver	<i>Aplodontia rufa nigra</i>
Steller (northern) sea lion	<i>Eumetopias jubatus</i>
Columbian white-tailed deer	<i>Odocoileus virginianus leucurus</i>
Salt marsh harvest mouse	<i>Reithrodontomys raviventris</i>

The Agencies survey for listed and proposed plant species in the vicinity of proposed projects. These surveys are designed to have a high likelihood of locating populations of such plants irrespective of whether surveys are also done for Protection Buffer and Survey and Manage species. Discovery and subsequent protection of populations of listed or proposed plant species through their own surveys removes effects that might result from any changes in status of species on Protection Buffer and Survey and Manage; therefore, for the three action alternatives, there will be no change in effect from the No-Action Alternative.

All projects proposed on BLM or Forest Service administered lands must meet the Aquatic Conservation Strategy objectives of the Northwest Forest Plan. As proposed projects are designed and analyzed for effects to listed fish, needs of the fish species and habitat elements required to meet Aquatic Conservation Strategy objectives will be identified. The proposed changes in Protection Buffer and Survey and Manage will not alter this assessment process; therefore, there will be no change in effect as a result of the changes in Protection Buffer and Survey and Manage Standards and Guidelines from the No-Action Alternative. Critical habitat for listed fish also corresponds with Riparian Reserves in the Northwest Forest Plan, and the objectives of the Aquatic Conservation Strategy.

The proposed changes in the Protection Buffer and Survey and Manage Standards and Guidelines will not affect the riparian-associated habitat of the California red-legged frog (*Rana aurora draytonii*). Although the most important habitat for red-legged frog is aquatic and riparian, this species is known to sometimes move through moist forest habitat during dispersal. Within the planning area, the listed range of the species may include some portions of the Mendocino and Shasta-Trinity National Forests, but due to the poor potential quality of the habitat (lack of narrow, incised channels and pools, dry chaparral/knobcone pine habitat, etc.), and elevation bands that the species is most likely to occur in, the alternatives being considered here should have little or no effect on the species (Bratch 2000, pers. comm.). Very few historical sightings for this species have been recorded in its very limited potential range in the area of the Northwest Forest Plan. The Agencies survey for listed species in the vicinity of proposed projects. These surveys are designed to have a high likelihood of locating populations of red-legged frogs irrespective of whether surveys are also done for Protection Buffer and Survey and Manage species. The species habitat will be provided a high level of protection through implementation of Aquatic Conservation Strategy objectives. Discovery of populations of listed species through their own surveys removes effects that might result from any changes in Protection Buffers and Survey and Manage. The alternatives being considered here have a very low likelihood of resulting in impacts to the species.

## Costs of Management

This section is divided into two major divisions. The General Background discussion illustrates cost incurred by the Agencies for implementing the Survey and Manage mitigation measure from 1994 to 1999. The Comparison of Alternatives discussion provides cost estimates of implementing the alternatives in the future as described in Chapter 2. Each of these major divisions are further subdivided into regional and field level costs. Regional costs include development of Survey Protocols and Management Recommendations, Field Guides, conducting strategic surveys (or extensive and general regional surveys in the No-Action Alternative), and data management and analysis. Field level costs include pre-disturbance surveys.

### General Background

The Northwest Forest Plan contains requirements to conduct surveys for Protection Buffer and Survey and Manage species and to manage known sites. This section describes the funds that have been expended on this effort to date.

The Northwest Forest Plan Record of Decision contained provisions for phasing in the development of survey protocols and surveys. The Agencies were to acquire information on known sites and begin management for Category 1 species immediately (1994). Pre-disturbance surveys were to start for great gray owl in 1995; and pre-disturbance surveys for red tree vole, lynx, and salamanders were to precede the design of all habitat-disturbing activities that would be implemented in 1997 or later. For another 80 species, pre-disturbance surveys were required before habitat-disturbing activities that would be implemented in fiscal year 1999 or later. The Northwest Forest Plan ROD also required that landscape-level surveys for fungi, plants, and arthropods were to be underway by fiscal year 1996. Survey Protocols and Management Recommendations have been developed as shown in Table 2-1. From 1994 through the end of fiscal year 1999, approximately \$10.6 million has been spent on this effort.

### Regional Costs

Regional costs include program management; development of Survey Protocols, Management Recommendations, and Field Guides; conducting strategic surveys (or extensive and general regional surveys in the No-Action Alternative); and data management and analysis.

*Program Management and Overhead:* Approximately \$600,000 was spent on program management that included the salary of agency staff conducting oversight and coordination of the Survey and Manage effort. Overhead includes items such as office space, telephones, and computers. Overhead costs are calculated at 22 percent.

*Management Recommendations, Survey Protocols, and Field Guides:* The development of Management Recommendations and Survey Protocols was given high priority as shown in Table 2-1. Approximately \$1,655,000 has been spent on this effort through fiscal year 1999. Field guides have also been developed to help with species identification of bryophytes, lichens, mollusks, and fungi. Approximately \$250,000 has been spent developing field guides.

*Training and Species Identification:* Annual training has been provided for survey protocol implementation and species identification. In fiscal year 1999 alone, approximately 425 people received training on pre-disturbance survey techniques and species identification. The cost of training, including salary and per diem, was approximately \$1,436,000 from 1994 to 1999. Specimen identification is also an ongoing cost for the species that are more difficult to identify. The cost for this work was approximately \$130,000.

*Extensive and General Regional Surveys:* The Agencies have spent approximately \$2,875,000 since 1994 on extensive and general regional surveys. Extensive and general regional surveys for fungi, lichens, and bryophytes were initiated in 1996. Two sub-teams (a regional Fungal Survey

Team and a regional Lichen/Bryophyte Survey Team) were formed to conduct surveys for these taxa. The teams have collected new information on distribution and habitat characteristics for most of these species, including habitat and range extensions for many species.

Knowledge on species ranges and habitats has grown as a result of these surveys. In some instances, this has allowed Survey Protocols and species management to become more focused; however, for most of the species there is substantial additional information needed to determine if the species meet the three basic criteria for being included in Survey and Manage.

**Data Management:** The Northwest Forest Plan ROD requires that information on known sites be incorporated into management decisions on projects in 1995 and subsequent years. To accomplish this task a “known site” database was developed. Data was gathered through searches of herbaria, museums, and private records to create this database. Approximately \$610,000 has gone into the development and update of the “known site” database. Thousands of sites are now being recorded annually from all levels of survey. Records of these sites are of value not only to the field unit where the site was found, but also to nearby field units and at a regional level to aid in describing the habitat and range extensions of the species as well as to determine if there still is concern for the species persistence. The Agencies developed the Interagency Species Management System (ISMS) at a cost of approximately \$1.1 million to address this data management need (see Appendix D). These two databases have now been combined.

Table 3&4-4 summarizes the regional costs incurred from 1994 to 1999.

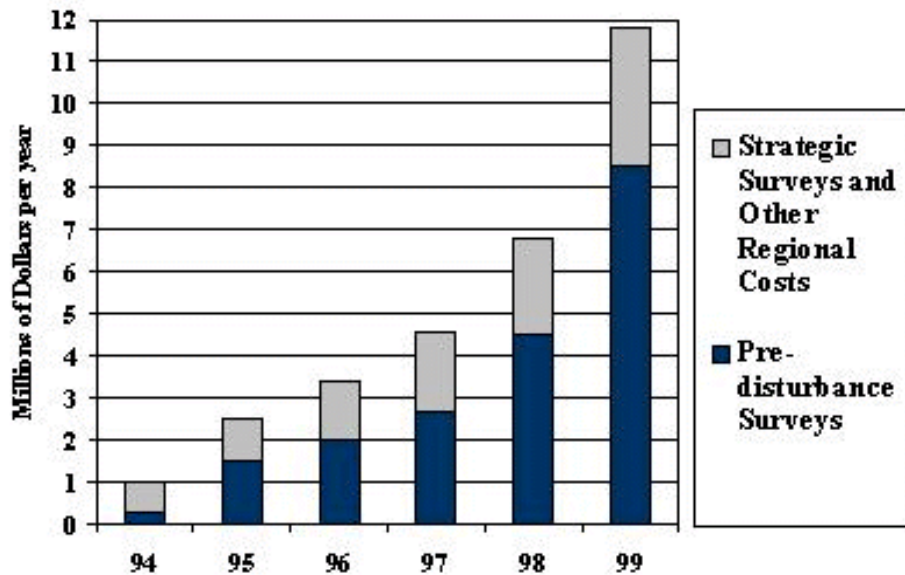
There are other costs not included in the calculation of regional costs. One such cost is monitoring of the Survey and Manage mitigation measure. Monitoring of the Northwest Forest Plan is conducted each year but it was not possible to separate out what portion of the monitoring cost was attributed to Survey and Manage versus other standards and guidelines. Ongoing and anticipated future monitoring costs are also not included in the Comparison of Alternatives sections for these same reasons. Another item not included was the cost of developing this Final SEIS.

### Field Level Costs (Pre-disturbance Surveys)

The biggest costs of implementing the Survey and Manage mitigation measure has been incurred by the individual administrative units (i.e. field units) of the Agencies. Since field units plan and implement habitat-disturbing activities, they are also responsible for conducting pre-disturbance surveys. The cost of pre-disturbance surveys are incorporated into project implementation costs. As shown in Figure 3&4-4, field level costs have increased each year, as additional species pre-disturbance surveys were required.

<b>Table 3&amp;4-4 - Regional Costs to Implement Survey and Manage (1994-1999)</b> <b>(Thousands of \$)</b>	
Program Management	600
Preparation of Survey Protocols, Management Recommendations, and Field Guides	1,905
Training and Species Identification	1,566
Extensive and General Regional Surveys	2,875
Known Site Data Base	610
Interagency Species Management System (ISMS)	1,100
<b>Subtotal</b>	<b>8,656</b>
Overhead at 22%	1,904
<b>Total with Overhead</b>	<b>10,560</b>

**Figure 3&4-4.** Cost of Survey and Manage, 1994 to 1999.



It is estimated that approximately \$11 million has been spent by field units for pre-disturbance surveys from 1994 to 1998, and approximately \$8.5 million was spent in 1999. These figures include 22 percent overhead. Additional costs were experienced by field units to rework projects when sites were found, but these cost are not included in these analyses.

Pre-disturbance surveys are of less value in gaining scientifically credible information that will aid in the management of these species than strategic surveys since there is no scientific selection criteria to allow expansion of the data gathered. However, pre-disturbance surveys play a key function in reducing risk to species by avoiding the loss of individuals or part of the populations.

Figure 3&4-4 summarizes the annual costs of implementing the Survey and Manage effort from 1994-1999 for both regional and field level units. As can be seen, approximately \$11.8 million was spent on both pre-disturbance surveys and regional cost for the Survey and Manage mitigation measure in 1999; with about 72 percent of this spent at the field level.

## Comparison of Alternatives

This section contains information regarding the estimated future costs of implementing the alternatives. As stated previously, regional costs and field level costs are discussed separately. A summary discussion at the end combines the regional and field level costs with totals by alternative for both short and long term. Costs have been estimated for the short term (1 to 5 years) and the long term (6 to 10 years) as costs are expected to decrease in later years as strategic surveys near completion and some species with “numerous” sites are removed from Survey and Manage.

These cost estimates are presented for comparative purposes only and to illustrate how cost estimates were derived. Actual implementation costs will vary.

## Regional Costs

### Strategic Surveys

The Northwest Forest Plan contains provisions for extensive and general regional surveys. These surveys are combined and described as strategic surveys and apply to all alternatives (see Chapter 2). In the future, strategic surveys are likely to be the biggest cost item at the regional level.

Strategic surveys would be conducted at three different scales: broad-scale, mid-to-fine scale, and detailed studies. It is assumed these surveys could be essentially completed in 5 to 10 years. Costs include, but are not limited, to: wages, vehicles, supplies, per diem, and record keeping. Strategic surveys are included for all species in the action alternatives. They would be conducted for the No-Action Alternative at a reduced cost. In the No-Action Alternative, only species in Category 3 or 4 from the Northwest Forest Plan would have these type of surveys, which excludes vertebrates, mollusks, most vascular plants, and eight bryophytes.

Broad-scale surveys would consist of gathering plot data. Costs would be the same for all action alternatives and would gather data for all species, except arthropods. The No-Action Alternative would cost approximately one-half as much as the figures listed below for the action alternatives. Broad-scale surveys are divided into three types:

1. Random plots - Random plots would be taken to help make statistically reliable population estimates. All species would be looked for and habitat data would be recorded. These plots would help determine rarity. Species that are projected to be common could be removed from the Survey and Manage Standards and Guidelines or be moved to a more appropriate management category. Plots would be random in nature but would be stratified to ensure that the appropriate number of plots fall in late-successional forests as well as other habitat types.

It is estimated that 5,500 plots would be visited by taxa experts at a cost of approximately \$2,500 per plot. These plots would cost a total of approximately \$13,750,000 or \$2,750,000 per year, if completed in 5 years.

2. Known site plots - A second type of broad-scale survey involves visits to selected known sites. This type of survey would be used to determine if the species was still present at the site, and plot data would be gathered to gain habitat information, if needed. For species with many known sites, a random selection of known sites would be revisited.

It is estimated that 2,500 plots would be taken at known sites. These plots would cost approximately \$1,000 for a total of \$2,500,000 or \$500,000 per year, if completed in 5 years.

3. Proposive surveys – A third type of broad-scale survey is proposive surveys. These are focused searches conducted where taxa experts anticipate finding the target species. These surveys would emphasize looking for the rarest species that may not be picked up in the random plots.

It is estimated that 2,000 days would be spent on proposive surveys. These surveys would cost approximately \$2,000,000 or \$400,000 per year, if completed in 5 years.

Mid-to-fine scale surveys would be conducted for the uncommon species to help define high-priority sites. (This includes 24 species in Categories 1C and 1D in Alternative 1, and the same 24 species in Category 3B in Alternative 3.) These surveys would not be required for the No-Action Alternative or Alternative 2. Survey cost would vary by species, but the total cost would be approximately \$6,100,000 or \$1,220,000 per year for 5 years.

Detailed studies involve studies not specifically targeted to finding known sites, but designed to answer questions regarding the species role in the ecosystem. These surveys apply to all alternatives. It is estimated by taxa experts that these studies would cost about \$7,500,000 or \$1,500,000 per year, if completed in 5 years.

Overhead costs are estimated at 22 percent by the Agencies. After adding in overhead, the total cost for strategic surveys is estimated to be approximately \$38,857,000 for Alternatives 1 and 3 (\$7,771,000 per year if completed in 5 years); \$31,415,000 for Alternative 2 (\$6,283,000 per year if completed in 5 years); and \$20,282,500 for the No-Action Alternative (\$4,056,500 per year if completed in 5 years). See Table 3&4-6 below.

### **Other Costs**

Program Management and Overhead: The cost of salaries for positions that oversee the Survey and Manage effort is expected to be approximately \$519,000 per year for all of the alternatives. The cost estimates in this section do not include overhead but it is included in each line item in the summary section in Tables 3&4-5 and 3&4-6.

Management Recommendations, Survey Protocols, and Field Guides: Updating Management Recommendations and Survey Protocols would cost approximately \$180,000 per year. Completing and updating field guides would cost approximately \$35,000 per year. The total cost of \$215,000 per year would apply to Alternative 2 and the No-Action Alternative.

Alternatives 1 and 3 contain provisions to identify high-priority sites for 24 species. This would result in the need to amend Management Recommendations and Survey Protocols. It is estimated that these Management Recommendations would cost \$50,000 to \$150,000 per species to update. This is in addition to the costs described above for mid-level strategic surveys. These updates are estimated to cost \$240,000 per year, if they are completed in 10 years. This cost is in addition to the levels already discussed for the other alternatives. As the Management Recommendations that define high-priority sites are finalized, there is the potential to realize cost savings for pre-disturbance surveys.

Alternative 3 differs from the other alternatives by requiring a standard buffer of 250 meters around sites for rare species. This would require updating Management Recommendations. Alternative 3 also requires equivalent-effort surveys, which require additional Survey Protocols and field guides not needed for the other alternatives. This would cost approximately \$50,000 per year for the first 2 years. This amount is in addition to that already discussed for other alternatives.

Training and Species Identification: Survey work is seasonal in nature and there is a high rate of employee turnover. Because of this turnover, the need for training is expected to remain somewhat constant. The cost of providing training would be approximately \$100,000 per year for all alternatives, except Alternative 3. In addition to this amount, the cost of salary and per diem for the trainees is estimated at \$278,000 per year. Specimen identification is also an ongoing cost for the species that are more difficult to identify. Costs for this work would be approximately \$80,000 per year for all alternatives except Alternative 3.

Training and species identification costs would increase under Alternative 3 since it requires equivalent-effort pre-disturbance surveys for 324 species, many of which are difficult to identify. Under Alternative 3, it is estimated that the cost for species identification would be \$290,000 per year, the cost to provide training would be \$200,000 per year, and the cost of salary and per diem for trainees would be about \$556,000 per year.

Data Management: It is estimated that approximately \$125,000 per year would be needed for data input and approximately \$225,000 per year would be needed for ISMS maintenance and data stewardship.

## Field Level Costs (Pre-disturbance Surveys)

The cost analysis for pre-disturbance surveys considers the range of the various species, the quantity of projects proposed by each administrative unit, and applies a cost per acre derived from recent field level experience (Nelson et al. 1999). Cost estimates below are averages for all species groups and for the Northwest Forest Plan area as a whole.

Table 3&4-5 displays the estimated acres per year requiring pre-disturbance surveys for planned timber harvest, prescribed fire, and other projects, summarized by state and agency. The timber sale figures were derived by using the currently declared PSQ figure of 811 million board feet and expanding the acres needed to achieve this level by 10 percent because many logistical factors result in the deletion of acres or projects after they are surveyed. Similarly, the prescribed fire acres were derived from an analysis of historic fire regimes. The fire acres displayed are for Alternative 1. The figures for the other alternatives vary due to the quantity of fuels treatments accomplished by the timber sale program that varies by alternative and are as follows: No-Action Alternative - 154,440 acres; Alternative 2 - 118,030 acres; and Alternative 3 - 161,150 acres. This quantity represents a substantial increase from the levels of prescribed fire accomplished in the past because of a renewed emphasis on re-establishing the role of fire in the ecosystem.

### Assumptions for Field Level Costs

A wide range of assumptions were made to arrive at an estimated cost per acre for pre-disturbance surveys. The acres by project type were gathered from various field units. The species were combined into taxa groups that have similar survey seasons and techniques. Information on cost per acre was averaged from actual field experience for each taxa group. The ranges of each species were examined to determine which field units had which species. A spreadsheet (Nelson et al. 1999) combined all of these factors and is contained in the analysis file for this SEIS.

The following costs per acre, by species or species group, were obtained from recent field experience:

- 5-year pre-disturbance surveys for six fall fruiting fungi (15 visits) - \$210
- 5-year pre-disturbance surveys for one spring fungus (15 visits) - \$120
- Equivalent-effort fungi (six visits) - \$84
- Lichens/Bryophytes/Perennial Fungi - \$14
- Amphibians - \$14
- Red-tree voles - \$30
- Great Gray Owl - \$15
- Terrestrial Mollusks - \$20
- Vascular Plants - \$7 and
- Aquatic Mollusks - \$0.77 (Aquatic mollusk costs per acre are low because most wetlands and streams are eliminated from projects prior to pre-disturbance surveys. The actual cost to survey streams was estimated to be \$300 per mile.)

<b>Table 3&amp;4-5. Number of Acres Needing Pre-disturbance Survey by Activity Type</b>			
<b>State/Agency</b>	<b>Timber Sales</b>	<b>Prescribed Fire</b>	<b>Other Projects</b>
Washington	10,660	28,690	1,760
Oregon	55,870	56,660	1,700
California	20,490	34,660	580
<b>Total</b>	<b>87,020</b>	<b>120,010</b>	<b>4,040</b>
Forest Service	73,700	99,200	3,690
BLM	13,320	20,810	350
<b>Total</b>	<b>87,020</b>	<b>120,010</b>	<b>4,040</b>

### Field Level Cost Estimates (Pre-disturbance Surveys)

The annual cost for pre-disturbance surveys ranges from approximately \$112 million for the No-Action Alternative to \$11 million for Alternative 2. Alternative 1 would cost about \$19 million and Alternative 3 would cost about \$50 million. Of this total estimated pre-disturbance cost for Alternative 1, approximately 55 percent of the total is for conducting pre-disturbance surveys for prescribed burning projects, 43 percent is for timber sale projects, and 2 percent is for other projects.

Regarding the No-Action Alternative, conducting the 5-year fungi pre-disturbance surveys would cost about \$89 million per year or about 79 percent of the total pre-disturbance costs. Actual implementation cost for the first few years for the No-Action Alternative, if selected, would vary by National Forest and BLM District depending on how many years worth of projects are identified and available to begin the 5-year fungi surveys. For many administrative units the actual cost would increase each year and the full cost of the 5-year fungi surveys may not be realized until the fifth year. The tables and charts, however, reflect the full cost. They are not intended to show how much the Agencies would spend in each of the early years, but are intended to show the total cost of surveying 1 years worth of projects. For fungi, the total cost accumulates over a 5-year period.

In terms of cost per acre surveyed, pre-disturbance surveys for the No-Action Alternative would cost approximately \$439 per acre. This is a cumulative figure that includes 5 years of fungi pre-disturbance surveys. Alternatives 1, 2, and 3 would cost \$85 per acre, \$49 per acre, and \$190 per acre respectively. These are weighted average figures for the entire Northwest Forest Plan area. Costs for individual administrative units would vary depending on the species mix in that area.

Another method of displaying cost of pre-disturbance surveys for the timber sale program is by displaying the cost per unit of volume. The cost per unit of volume can be calculated for the region as a whole. The increased cost for pre-disturbance surveys in the No-Action Alternative would be approximately \$82 per thousand board feet (MBF). Alternatives 1, 2, and 3 would cost an additional \$11 per MBF, \$6 per MBF, and \$40 per MBF, respectively. For comparison, the cost to prepare the average timber sale without considering pre-disturbance survey costs is approximately \$150 per MBF. However, timber sale preparation costs vary widely across the Northwest Forest Plan area.

The following additional items may influence costs to field-level administrative units but are not included in the cost estimates presented.

1. When sites are found, projects have to be redesigned to manage for these species. Some species may be found to be more common than anticipated. Until changes are made using the adaptive management process, the sites found for these species would impact programs and raise costs. Additional field layout work would result in higher implementation costs.
2. Even though one of the assumptions is that funding for pre-disturbance surveys would be available, most projects would still have to undergo economic analysis to determine project viability. Some projects, because of the cost of pre-disturbance surveys or the cost of making the needed changes, may be judged to be economically unviable. For example, for some alternatives, the costs of pre-disturbance surveys alone could double or triple the cost of accomplishing prescribed fire for ecosystem enhancement. If projects were deleted, the costs already incurred would be lost. The No-Action Alternative and Alternative 3 would have greater impact on the viability of projects in comparison to the other alternatives.



## Summary of Survey and Manage Costs

### Estimated Short-Term Costs (1-5 years)

Table 3&4-6 and Figure 3&4-5 summarize costs for the Survey and Manage Standards and Guidelines discussed above, by alternative, for the short-term. Total annual costs range from \$117 million for the No-Action Alternative to \$19 million for Alternative 2. Actual annual funding needs would vary depending on several factors including the actual project acres proposed each year and the rate at which strategic surveys are completed. Figure 3&4-5 graphically shows these costs by alternative and also provides 1999 expenditures for comparison. Expenditures for 1999 did not approach the level shown for the No-Action Alternative for the following reasons: (1) pre-disturbance surveys for 32 species (multi-year fungi, bryophytes, and mollusk pre-disturbance surveys) were deferred; (2) the complete array of strategic survey components elaborated by the action alternatives was not underway in fiscal year 1999; and, (3) for some species, such as red tree vole and Larch Mountain salamander, the land area where pre-disturbance surveys is required, has expanded since 1999.

Figure 3&4-5 and Table 3&4-6 both show short-term annual costs for the purpose of comparing alternatives. The actual funding needed is likely to deviate from these figures over time. The many assumptions used to generate these figures add to the level of uncertainty. See Table 3&4-7 for long-term estimates.

**Figure 3&4-5.** Short-Term Costs for Survey and Manage Standards and Guidelines (Annual Costs for the First 5 Years).

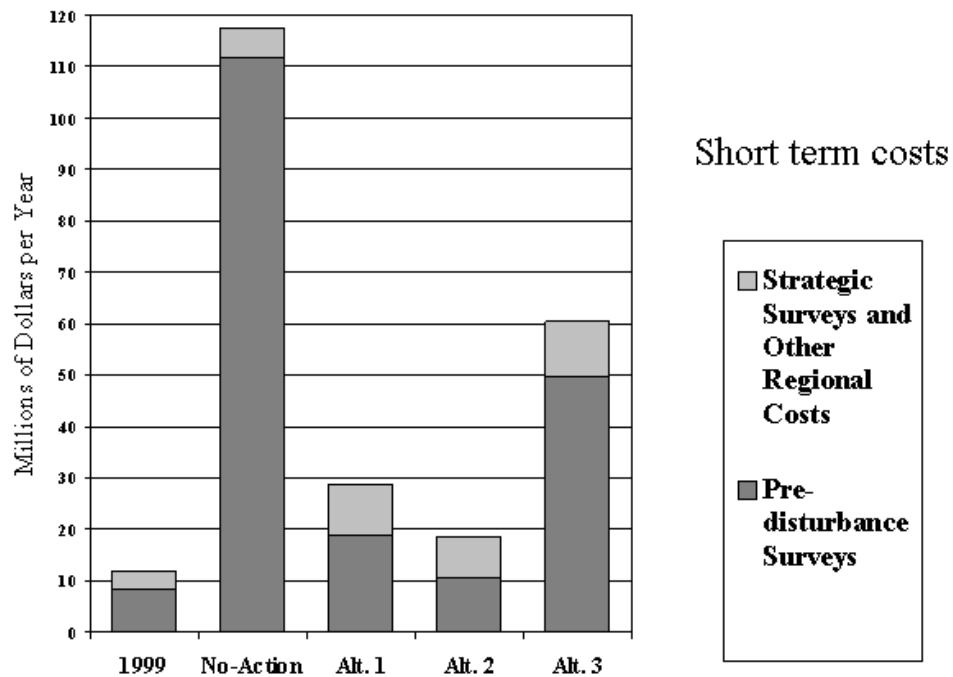
### Estimated Long-Term Costs (6-10 years)

The cost per year of implementing the Survey and Manage effort will decrease in the long term (6-10 years) when compared to the short-term costs discussed above. Long-term costs would be lower for the following reasons.

1. Most broad-scale strategic surveys would be completed. While portions of the strategic surveys such as propogative surveys and micro-scale studies may continue, the random plots and the mid-level surveys may be completed and their associated annual costs would end.

<b>Table 3&amp;4-6. Annual Short-Term Costs for Survey and Manage by Alternative</b> (In millions of dollars)				
<b>Cost Element (includes overhead)</b>	<b>No-Action</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
<b>Field Level Costs</b>				
Pre-disturbance Surveys for Timber	42.0	8.2	4.7	18.2
Pre-disturbance Surveys for Fire	67.7	10.3	5.7	30.7
Pre-disturbance Surveys for Other	1.9	0.4	0.2	0.8
Pre-disturbance Surveys Total	111.7	18.8	10.6	49.7
<b>Regional Costs</b>				
Strategic Surveys	4.0	7.7	6.3	7.7
Field Guides, Management Recommendations, Survey Protocols	0.3	0.6	0.3	0.6
Program Management	0.5	0.5	0.5	0.5
Data Management	0.4	0.4	0.4	0.4
Training, Species Identification	0.6	0.6	0.6	1.3
<b>Total Annual Costs</b>	<b>117.5</b>	<b>28.6</b>	<b>18.7</b>	<b>60.3</b>

**Figure 3&4-5.** Short-Term Costs for Survey and Manage Standards and Guidelines (Annual Costs for the First 5 Years).



2. After high-priority sites have been defined for Alternatives 1 and 3, there would be reduced costs for pre-disturbance surveys since some portions of the ranges of the uncommon species would no longer need to be surveyed.
3. As knowledge is gained about species through strategic surveys, the adaptive management process would likely result in some species being removed from the Survey and Manage mitigation measure or moved to a category that results in reduced costs.
4. Future changes to Management Recommendations and Late-Successional Reserve Assessments will describe circumstances where pre-disturbance surveys are not needed prior to certain types of prescribed fire. When these changes are completed, there should be reduced costs. Areas that may have been infeasible to burn due to the cost of pre-disturbance surveys or the quantity of known sites may then be available to burn. This approach is not applicable to the No-Action Alternative.
5. Under the action alternatives, species may change categories and there may be species added to Survey and Manage in the future. This adds uncertainty to these cost estimates. However, the relative differences between the alternatives would not change.
6. For cost analysis purposes, it was assumed that strategic surveys for “1B” species would be completed on schedule and that equivalent-effort, pre-disturbance surveys would not be required in old growth for the 189 fungi, 15 lichens, 11 bryophytes, and 7 mollusks in this category. This assumption is consistent with completing these strategic surveys on schedule. However, if strategic surveys are not completed as projected, pre-disturbance costs could increase over projections provided in this section.

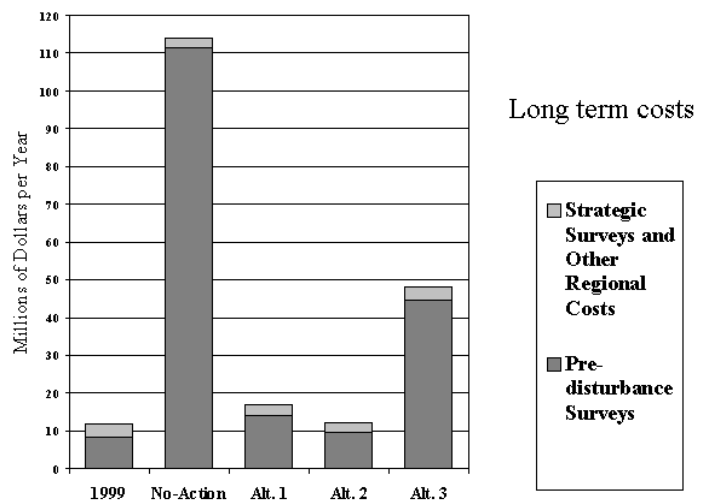
These long-term cost estimates illustrate a reduction in costs compared to the short-term. The No-Action Alternative would result in a 3 percent reduction in annual costs. The long-term reduction for Alternatives 1, 2, and 3 would be 41 percent, 34 percent, and 20 percent, respectively.

In terms of cost per acre surveyed, pre-disturbance surveys for the No-Action Alternative would cost approximately \$439 per acre. This is a cumulative figure that includes 5 years of pre-disturbance surveys for fungi. Alternatives 1, 2, and 3 would cost \$64 per acre, \$44 per acre, and \$171 per acre, respectively. These are weighted average figures for the entire range of the Northwest Forest Plan. Costs for individual units would vary depending on the species mix in that area.

As with the short term for the timber sale program, the cost per unit of volume for pre-disturbance surveys can be displayed for the region as a whole. The increased cost for pre-disturbance surveys for the No-Action Alternative would be approximately \$82 per MBF. Alternatives 1, 2, and 3 would increase cost an additional \$8 per MBF, \$5 per MBF, and \$36 per MBF, respectively.

<b>Table 3&amp;4-7. Annual Long-Term Costs for Survey and Manage by Alternative (In millions of dollars)</b>				
<b>Cost Element (includes overhead)</b>	<b>No-Action</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
<b>Field Level Costs</b>				
Pre-disturbance Surveys for Timber	42.0	6.1	4.2	16.4
Pre-disturbance Surveys for Fire	67.7	7.7	5.2	27.6
Pre-disturbance Surveys for Other	1.9	0.3	0.2	0.8
Pre-disturbance Surveys Total	111.7	14.1	9.6	44.7
<b>Regional Costs</b>				
Strategic Surveys	0.6	1.0	1.0	1.0
Field Guides, Management Recommendations, Survey Protocols	0.3	0.3	0.3	0.3
Program Management	0.5	0.5	0.5	0.5
Data Management	0.4	0.4	0.4	0.4
Training, Species Identification	0.6	0.6	0.6	1.3
<b>Total Annual Costs</b>	<b>114.0</b>	<b>16.8</b>	<b>12.3</b>	<b>48.2</b>

**Figure 3&4-6.** Long-Term Costs for Survey and Manage Standards and Guidelines (Annual Costs for Years 6-10).



## **Socioeconomic Effects**

The Northwest Forest Plan Final SEIS addressed socioeconomic effects. This SEIS examines alternative ways to change only one aspect of the Northwest Forest Plan Record of Decision. This SEIS is tiered to those documents and does not repeat the analysis and conclusions that are unaffected by the proposals in this SEIS. The following analysis presents information on effects that would be different than those identified in the Northwest Forest Plan Final SEIS. In many cases, effects are of the same type identified in the Northwest Forest Plan Final SEIS but vary in scope or extent as a result of alternatives analyzed here. In these instances, the same assumptions used in the Northwest Forest Plan Final SEIS are used in this SEIS.

## **Mineral Resources**

Under the No-Action Alternative, new leaseable and saleable mineral activities would require pre-disturbance surveys as part of required plans of operation. Project proponents would be required to conduct surveys and implement reasonable mitigation. The time period between project proposal and actual mineral development would be 5 years for completion of surveys for some fungi species under the No-Action Alternative. All action alternatives reduce this time period to 2 years or less. Some very small (less than 5 acres) locatable mineral operations are not required to prepare a plan of operation; these would not be subject to Survey and Manage species requirements. The 1872 mining law may limit the need for pre-disturbance surveys for locatable minerals because Management Recommendations would be subordinate to this law. However, only minimum acreage would potentially be disturbed within the Northwest Forest Plan area.

Current Management Recommendations identify sedimentation, changing microclimate, alterations to hydrology, water diversions, physical destruction and trampling, and spread of noxious and invasive plants as threats to known sites. If these threats can be avoided or mitigated, mining activities could be compatible with management of known sites. Mineral development in accordance with the Management Recommendations is potentially constraining to mineral activities. This could increase the costs of mineral exploration and extraction, or prevent surface disturbance or occupancy, resulting in less mining on federally managed lands in areas containing known sites and potential habitat.

Impacts to mining are correlated to the number of species requiring pre-disturbance surveys, the length of the survey period, and the number of acres of existing and projected known sites that would be managed. The No-Action Alternative would have the greatest impact because of 5-year survey requirements for some fungi species that could delay mining activities. Also, 63 species would continue to be subject to Survey and Manage Standards and Guidelines; these species are removed from the Survey and Manage Standards and Guidelines under all action alternatives. Among the action alternatives, management of known sites and the number of species requiring pre-disturbance surveys are the primary factors affecting mineral development. Strategic surveys and incidental site finds are not anticipated to have a meaningful impact to mineral activities because these activities are typically site-specific project proposals. Management of known sites impacts mineral activities because mitigation actions would be required in accordance with Management Recommendations. Alternative 3 would have the greatest impact because of the 250-meter (48.5 acre) buffer around known sites. Acres within managed known sites is greatest under Alternative 3, followed by the No-Action Alternative and Alternative 1. Acres within managed known sites is least under Alternative 2. The number of species requiring pre-disturbance or equivalent-effort surveys is greatest under Alternative 3, followed by the No-Action Alternative and Alternative 1. The number of species requiring pre-disturbance surveys is least under Alternative 2.

## Range/Grazing Resources

Under the No-Action Alternative, known sites for 10 mollusk species and 1 vascular plant species (*Pedicularis howellii*) would continue to be protected from grazing (see Table 2-7). Future sites discovered through pre-disturbance and strategic surveys would also be protected. The action alternatives would eliminate this specific direction and incorporate the three mollusk species into the Survey and Manage process. Seven of the 10 mollusk species are already included in the Survey and Manage process. Under the action alternatives *Pedicularis howellii* would be removed from the Survey and Manage Standards and Guidelines under all alternatives because it is not associated with late-successional or old-growth forests.

Current Management Recommendations identify sedimentation, browsing, trampling, and spread of noxious and invasive plants as threats to known sites. Exclosures, changes in seasons of use, and integrated weed management are identified as mitigation measures.

Impacts to grazing are not discernibly different among the alternatives. Pre-disturbance surveys, management of known sites, and strategic surveys are not anticipated to change the conclusions of the Northwest Forest Plan Final SEIS regarding impacts to grazing. That document concluded, “...consequences to the industry would be small based on the relatively minor amount of range production on federally managed lands within the planning area. These modifications would likely have consequences, however, for individual permittees” (USDA, USDI 1994a, p. 3&4-276).

## Special Forest Products

Under all alternatives, the need for pre-disturbance surveys would be based on the Agencies’ determination of the types of special forest products collections that would disturb habitat.

Existing Management Recommendations identify special forest product collection as a threat to known sites for only two species, both vascular plants. Using rakes to collect matsutake mushrooms threatens mycorrhizal networks important to *Allotropa virgata*. Collection of moss threatens *Botrychium montanum* (USDA, USDI 1998c).

The number and extent of pre-disturbance surveys required will determine the impacts to Forest Service and BLM special forest products programs. Alternative 3, with 319 species subject to pre-disturbance surveys, has the greatest potential impact. The No-Action Alternative is next, followed by Alternative 1, and finally Alternative 2 with the least number of species requiring pre-disturbance surveys. Strategic surveys and management of known sites are not expected to impact collection of special forest products, except for the two species mentioned above.

## Commercial and Subsistence Fisheries Resources

None of the alternatives are anticipated to directly impact commercial or subsistence fisheries. Northwest Forest Plan activities are expected to indirectly “aid in the production of commercial and Indian subsistence fisheries” (USDA, USDI 1994a, p. 3&4-278). Existing Management Recommendations emphasize maintaining or enhancing water quality at known sites. This is consistent with riparian and water quality objectives in the Northwest Forest Plan.

Construction of in-stream structures and other habitat improvements could require pre-disturbance surveys under all alternatives. Pre-disturbance surveys add an additional step and could delay implementation of projects but they are not anticipated to affect achievement of riparian and water quality objectives. The number of species requiring pre-disturbance surveys will determine the impacts to the Agencies watershed enhancement programs. As such, Alternative 3 has the greatest potential impact, followed by the No-Action Alternative, Alternative 1, and, finally, Alternative 2 with the least impact. Strategic surveys and management of known sites are not expected to impact implementation projects to improve riparian and water quality.

## **Recreation Resources**

Under the No-Action Alternative, recreation areas would be managed to minimize disturbance to known sites. New recreation facilities or expansion of existing facilities would require pre-disturbance surveys under all alternatives.

Current Management Recommendations list threats to known sites from recreation as picking, physical destruction and trampling, firewood collection, and spread of noxious and invasive plants. Mitigation measures such as relocation of roads, trails, and recreation facilities, and OHV closures are recommended for known sites susceptible to these threats (Castellano and Thomas 1997 and USDA, USDI 1998c).

The number and extent of pre-disturbance surveys required would determine the impacts to the Agencies recreation development programs. Therefore, Alternative 3 has the greatest potential impact followed by the No-Action Alternative, Alternative 1, and, finally, Alternative 2 with the least impact. Avoidance and mitigation measures associated with management of known sites are not expected to have a meaningful impact on recreation opportunities for the general public because most recreational uses are not habitat-disturbing and could occur at most known sites with appropriate mitigation measures.

## **Lumber and Wood Products Employment**

Actual timber harvest, a primary driver of economic, community, and social effects, has lagged behind levels projected in the Northwest Forest Plan Final SEIS for a variety of reasons including: the time lag between sale and harvest; appeals; lawsuits; listing of new species under the Endangered Species Act; difficulties in implementing the Survey and Manage Standards and Guidelines, as originally anticipated; and Rescission Act Sales. Factors other than declining federal timber harvest have also influenced the lumber and wood products industry in the region. These include technological changes, growth in the manufactured home industry, and competition from other regions (particularly the South), international competition, and wood products imports.

The Northwest Forest Plan Final SEIS estimated employment affected per million board feet of timber processed by subregion. A region-wide average was also estimated. Since no new information is available to revise these statistics, they continue to be used for analytical purposes within the Northwest Forest Plan area. An estimated 9.08 jobs are generated within the region per million board feet harvested and processed. The current (1998 annual average) employment in the lumber and wood products industry is approximately 58,500 people in Oregon, 49,200 people in Washington, and 10,740 people in northern California counties (Oregon Employment Department 1999, State of California 2000, and Washington State Employment Security 1999). The employment figure for Oregon includes the paper industry.

Lumber and wood products employment changes have been close to the impacts projected in the Northwest Forest Plan Final SEIS (USDA, USDI 1994a). Actual employment declines between 1990, the baseline used in the Northwest Forest Plan Final SEIS, and 1998 have been about 7,000 jobs in Washington, 14,700 jobs in Oregon, and 3,160 jobs in northern California. Projected changes under the alternative selected in the Northwest Forest Plan Record of Decision (Alternative 9) were: 9,500 in western Washington, 16,700 in western Oregon, and 2,800 in northern California.

The No-Action Alternative has a higher effect than the action alternatives. Under the No-Action Alternative, available timber harvest would support an estimated 4,630 jobs. This is approximately 3,470 fewer jobs than estimated by the Northwest Forest Plan Final SEIS. Actual implementation of survey protocols, particularly for fungi species, would result in a start-up period before anticipated sale volumes could be reached. Additional employment impacts are anticipated during the start-up period. The action alternatives would greatly reduce the length of the start-up period.

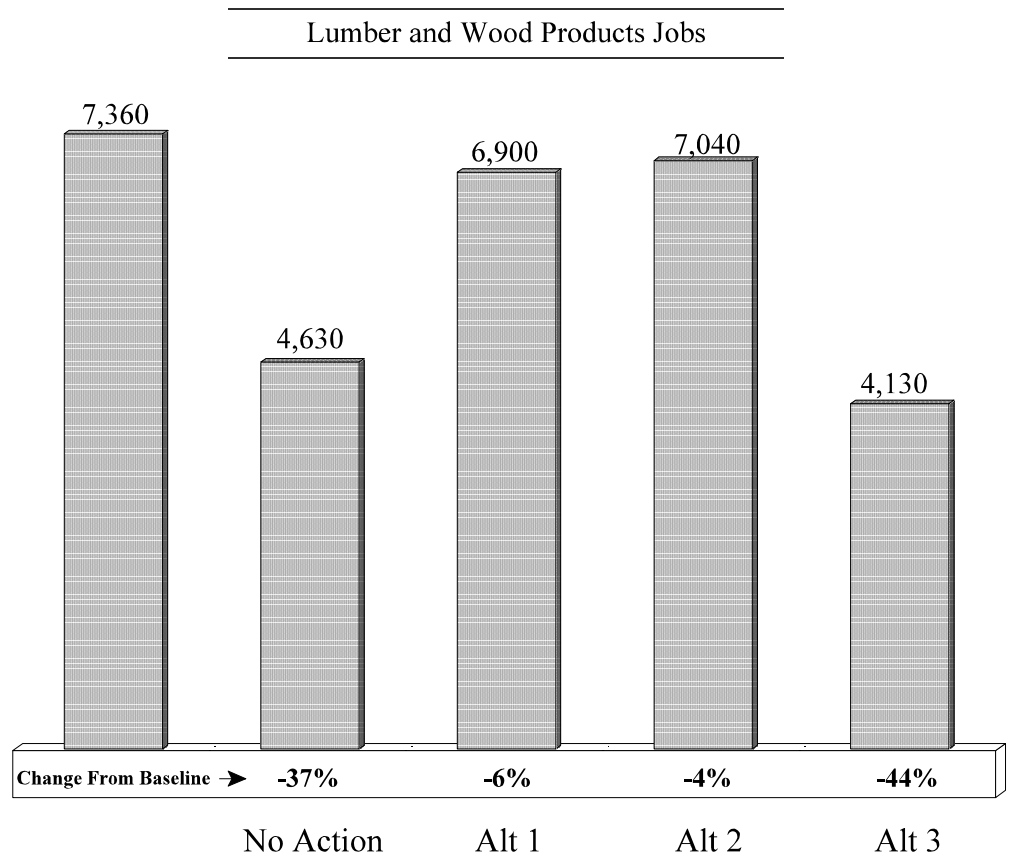
Under Alternatives 1 and 2 timber harvests would be reduced below levels anticipated in the Northwest Forest Plan Final SEIS, but would be greater than under the No-Action Alternative. Under Alternative 1, available timber harvest would support an estimated 6,900 jobs. This is approximately 2,270 more jobs than estimated under the No-Action Alternative. Under Alternative 2, available timber harvest would support an estimated 7,040 jobs. This is approximately 2,410 more jobs than estimated under the No-Action Alternative.

Under Alternative 3 timber harvest would be reduced below levels anticipated in the No-Action Alternative. Under Alternative 3, available timber harvest would support an estimated 4,130 jobs. This is approximately 500 fewer jobs than estimated under the No-Action Alternative. See Table 3&4-8 for a summary of estimated annual employment associated with federal timber harvest.

<b>Table 3&amp;4-8 Estimated Annual Employment Associated with Federal Timber Harvest, Jobs</b>				
	<b>No-Action</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
Long-term harvest (mmbf)	510	760	775	455
Employment @ 9.08 jobs/mmbf	4,630	6,900	7,040	4,130

Values have been rounded for display purposes.

**Figure 3&4-7. Lumber and Wood Products Jobs.**



## Survey-Related Employment

The Costs of Management section earlier in this chapter examines the estimated costs of implementing each alternative. The assumptions used to build those estimates include direct survey costs (such as labor, vehicles, equipment, and lab fees) and overhead. Labor costs were assumed to represent 46.8 percent of total survey costs. This represents 60 percent of costs after deduction of overhead. Table 3&4-9 displays the estimated total cost by alternative and the portion attributed to labor.

Currently, federal land-managing agencies hire a temporary and seasonal workforce to assist the Agencies' employees to conduct required surveys, while some surveys are conducted through contracts. The Oregon Employment Department publishes wage information annually for specific "occupational titles," but no specific occupational title exists for biological survey workers. There are three titles, however, that generally address the tasks associated with biological surveyors: Biological, Agricultural, and Food Technicians; Forest and Conservation Workers; and Surveying and Mapping Technicians. The weighted average median wage for these occupations was \$12.85 per hour (Oregon Employment Department 1999). For comparison, the weighted average median wage for the 22 major occupational titles in the Lumber and Wood Products industry was \$13.03 per hour (Oregon Employment Department 1999 and Stevenson 2000, pers. comm.).

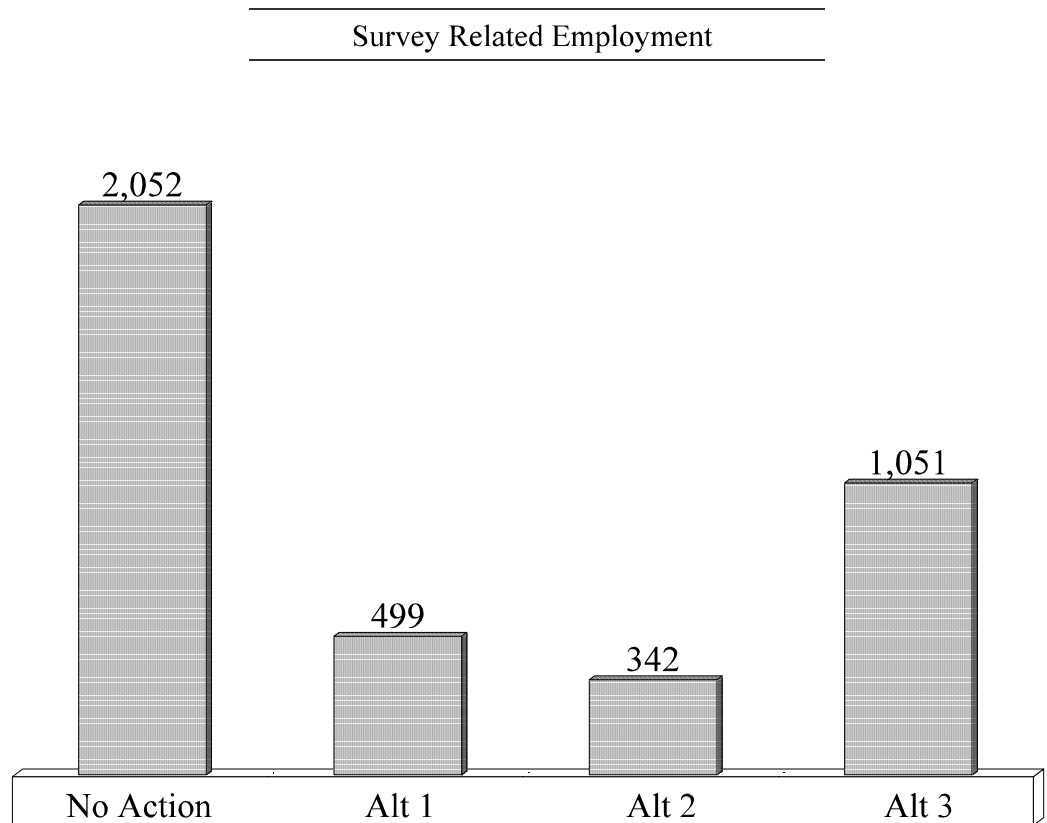
Also, the analysis assumed year-round employment, 40 hours per week, and 2,080 hours per year. Expressing employment in terms of full-time-equivalent positions is not synonymous with jobs created, because most survey-related jobs are seasonal. The length of employment and season is highly variable, depending on the species and Survey Protocol.

The Northwest Forest Plan Final SEIS did not specifically anticipate employment associated with species surveys. However, an estimated 2,052 survey-related jobs would be supported under the No-Action Alternative. Under Alternative 1, an estimated 499 full-time-equivalent jobs would be supported. This is approximately 1,153 fewer jobs than estimated under the No-Action Alternative. Under Alternative 2, an estimated 342 full-time equivalent jobs would be supported. This is approximately 1,710 fewer jobs than estimated under the No-Action Alternative. Under Alternative 3, an estimated 1,051 full-time equivalent jobs would be supported. This is approximately 1,001 fewer jobs than estimated under the No-Action Alternative. Table 3&4-10 and Figure 3&4-8 display estimated annual pre-disturbance survey-related employment, expressed as full-time-equivalent positions, by alternative.

<b>Table 3&amp;4-9 Estimated Total Cost By Alternative and Portion Attributed to Labor (in dollars)</b>				
<b>Costs</b>	<b>No-Action</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
Total Cost	117,480,000	28,638,000	18,667,000	60,313,000
Labor Cost	54,980,640	13,402,584	8,736,156	28,226,484

<b>Table 3&amp;4-10 Annual Survey-Related Employment, Full-Time Equivalent Jobs</b>			
No-Action	Alternative 1	Alternative 2	Alternative 3
2,052	499	342	1,051



**Figure 3&4-8.** Survey-Related Employment.

In the longer term, survey-related employment is anticipated to decline under the action alternatives because:

1. Most strategic surveys would be completed.
2. Identification of high-priority sites under Alternatives 1 and 3 is expected to reduce pre-disturbance survey requirements in areas outside priority ranges for some species.
3. The adaptive management process may remove species from the Survey and Manage process.
4. Changes to Management Recommendations to include prescribed fire as an acceptable management practice within Late-Successional Reserves and areas managed similar to Wilderness where compatible with species life cycles.

## Government Revenues

The analysis of impacts to government revenues in the Northwest Forest Plan Final SEIS did not include legislation that has provided an ongoing "special payment amount," also known as safety net payments. Current law provides for annual payments based on a declining percentage of the 1986-1990 average payment. This legislation expires in fiscal year 2003. Pending legislation, S. 1608, passed September 13, 2000, provides for annual payments based on the average of the highest 3 years of payments between 1986 and 1999. If signed into law, the legislation applies to the BLM "50-percent payments" and to the Forest Service "25-percent payments" through fiscal year 2006. The legislation also allows for annual increases based on the Consumer Price Index.

With expiration of any safety net legislation, revenue sharing with the counties would again be based on current timber and other resource receipts. Revenues would likely be less than before the Northwest Forest Plan given the lower harvest levels. This would occur in spite of notable increases in timber prices since the late 1980's.

To the extent that the No-Action Alternative and Alternatives 1, 2, and 3 reduce federal timber harvest below levels anticipated in the Northwest Forest Plan Final SEIS, federal revenue sharing would also be reduced beginning in 2004. Reductions would be greatest under Alternative 3, followed by the No-Action Alternative, then Alternative 1. The least reductions would occur under Alternative 2. Effects of reduced payments to the counties would be the same type as those identified in the Northwest Forest Plan Final SEIS, but to a greater extent.

*“Under current policies, declines in federal timber harvest will reduce federal receipts to counties. ...Any reduction in these federal receipts shared with the counties...will correspondingly impact their school and road funds due to the nature of the distribution formula...”* (USDA, USDI 1994a).

## Community Capacity

Community capacity involves the ability of residents, community institutions, organizations, and leadership (formal and informal) to meet local needs and expectations. None of the alternatives would change the capacity ratings assigned by the Northwest Forest Plan Final SEIS.

The Northwest Forest Plan Final SEIS concluded that negative impacts to communities and regions with lower capacity were highly correlated to harvest levels. This was because “the effects...on rural communities are primarily those which flow directly and indirectly from changes in the regional and local economies.” To the extent that the No-Action Alternative and Alternatives 1, 2, and 3 reduce federal timber harvest below levels anticipated in the Northwest Forest Plan Final SEIS, community and regional impacts would increase. Impacts to low capacity regions and communities would be greatest under Alternative 3, followed by the No-Action Alternative, Alternative 1. Impacts to low capacity regions and communities would be least under Alternative 2. In the short term, the No-Action Alternative would have the greatest effect because its requirement for 5-year surveys for some fungi species would result in implementation delays. Effects to the local economies would be the same type as those identified in the Northwest Forest Plan Final SEIS, but to a greater extent (USDA, USDI 1994a Pages 298-305).

## People Coping with Change

Four factors of social and cultural disruption were noted by the Northwest Forest Plan Final SEIS (USDA, USDI 1994a, p. 3&4-307). The first three of these four factors would be influenced by some or all of the alternatives in this SEIS.

The first factor is “a shift from decentralized participatory forest land management that is oriented toward communities and workers to a centralized command and control for forests both public and private” (USDA, USDI 1994a, p. 3&4-307). All alternatives, including the No-Action Alternative, would continue this trend as anticipated in the Northwest Forest Plan Final SEIS by maintaining Survey and Manage Standards and Guidelines as an important regional, interagency activity with regional Management Recommendations and Survey Protocols.

The second factor is “the perception that the federal government has reneged on its commitment to maintain nondeclining, even flow of timber from federal forests” (USDA, USDI 1994a, p. 3&4-307). Under the No-Action Alternative, the ability to meet harvest predictions made by the Northwest Forest Plan is reduced because “overlapping and unclear direction has resulted in funding surveys that may not be necessary or are inefficient, given species management objectives. Project costs have been unreasonably expensive and time consuming, which reduces

the number of management activities that can be done because of limited funds and personnel” (see Chapter 1). Alternatives 1, 2, and 3 also appear to reduce, by varying degrees, the ability to meet harvest predictions made in the Northwest Forest Plan Final SEIS.

The third factor is “a social structure that is less likely to adapt to a permanent loss of employment” (USDA, USDI 1994a, p. 3&4-307). To the extent that the No-Action Alternative and Alternatives 1, 2, and 3 reduce federal timber harvest below levels anticipated in the Final SEIS, additional social and cultural disruptions would be expected (see Lumber and Wood Products Employment earlier in this chapter).

The fourth factor is “the potential for conflict among different people in which the timber industry and workers, as well as other interest groups, are negatively stereotyped and stigmatized” (USDA, USDI 1994a, p. 3&4-307). No change is anticipated in the level of controversy associated with public land management generally, and late-successional or old-growth forests specifically, because this SEIS addresses only one of many issues associated with federal land management.

As stated in the Northwest Forest Plan Final SEIS “these factors can impose a significant emotional impact, and all can undermine individual and community efforts to successfully adapt to changes” (USDA, USDI 1994a, p. 3&4-307).

## Environmental Justice

Environmental Justice was not specifically addressed by the Northwest Forest Plan Final SEIS. Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994) requires that all federal agencies “make achieving Environmental Justice part of [their] mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

Twenty-nine of the 51 counties covered by the Northwest Forest Plan have poverty rates above the rate for the state in which they are located. Three of the 51 counties covered by the Northwest Forest Plan have African American populations above the rate for the state in which they are located. Five of the 51 counties under the Northwest Forest Plan have Asian or Pacific Islander populations above the rate for the state in which they are located. Nine of the 51 counties covered by the Northwest Forest Plan have Hispanic (any race) populations above the rate for the state in which they are located. Twenty-nine of the 51 counties covered by the Northwest Forest Plan have Native American populations above the rate for the state in which they are located (Frewing-Runyon 1999). There are 25 federally recognized tribes in California and 36 in Oregon and Washington (USDA, USDI 1994a, p. 3&4-314).

The following potential impacts to environmental justice of all alternatives have been identified. The scope of these impacts varies among the four alternatives.

Native American issues and subsistence uses:

- Reductions in harvest reduce the likelihood that cultural sites and other special or religious sites would be damaged.
- Subsistence uses (such as bark and root collecting) may be suspended or restricted until surveys can be completed for activities that are deemed habitat disturbing by the Agencies.

These impacts to subsistence uses may impact treaty-reserved rights and, therefore, the Agencies ability to execute its trust responsibilities. The protection of tribal treaty rights and trust resources is addressed starting on page 54 of the Northwest Forest Plan ROD. Through the scoping and public involvement process on this SEIS there has been no specific identification of Survey and Manage species that are a particular concern of, or in use by, tribes.

There is high participation by minority and low-income populations in collecting special forest products. Permits for collecting wild plants, some mosses, bark, roots, and boughs could be restricted until surveys can be completed where such collections are deemed habitat disturbing by the Agencies.

## **Species Values**

Species protection contributes to a variety of social values. Previous effects sections focused on economic outcomes, as expressed by employment and the value of products sold in the marketplace. This section focuses on social outcomes, as expressed by types of social values.

The Survey and Manage species examined in this SEIS have no known *use value* to people. They are not collected for food, shelter, or decoration. However, they have a variety of non-use values, which include ongoing and new scientific research, and recreational observation and photography.

Many people value the persistence of these species for reasons unrelated to actually observing these species. These include their roles as indicators of healthy ecosystems for other species and humans, indicators of public land management responsibility, and the protection of environmental quality.

Looking to the future results in “option values.” These values are associated with undiscovered uses whether they are culinary, medicinal, or research. The possibility remains that these species may play an undiscovered yet critical role in healthy ecosystems for humans. “Bequest values” recognize that future generations will also value species for the same reasons they are currently valued and may discover additional use, non-use, existence, and option values.

To the extent that species persistence is assured by the alternatives, the types of species values discussed above would be maintained.

## **Timber Harvest**

### **Background and Affected Environment**

Each alternative would directly affect the level of timber available for harvest from forest lands administered by the Forest Service and the BLM within the planning area. The purpose of this section is to display the effects of the alternatives on the Probable Sale Quantity (PSQ) at the Northwest Forest Plan scale (24.5 million acres) to provide a relative comparison between the alternatives. Effects at the administrative unit would vary from this regional-level analysis. This analysis is not intended to have the precision necessary for re-declaring the PSQ for the National Forests and BLM Districts. Further, the alternatives in this SEIS do not authorize timber sales or other habitat-disturbing activities. The decision to harvest timber is made in site-specific, project-level decisions that implement the land and resource management plans of the administrative units.

The federal forests of the region are managed under a non-declining yield mandate. This direction means that scheduled annual harvest levels can be maintained without decline over the long term, if the Agencies adhere to land allocations and associated standards and guidelines, and to the planned schedule of harvest and regeneration. The Northwest Forest Plan established the term Probable Sale Quantity for estimates of average annual sale levels likely to be achieved, in lieu of using the term Allowable Sale Quantity (ASQ), which estimates the upper-limit harvest levels. The use of the term PSQ recognizes the inherent uncertainties in the estimates (Johnson et al. 1993).

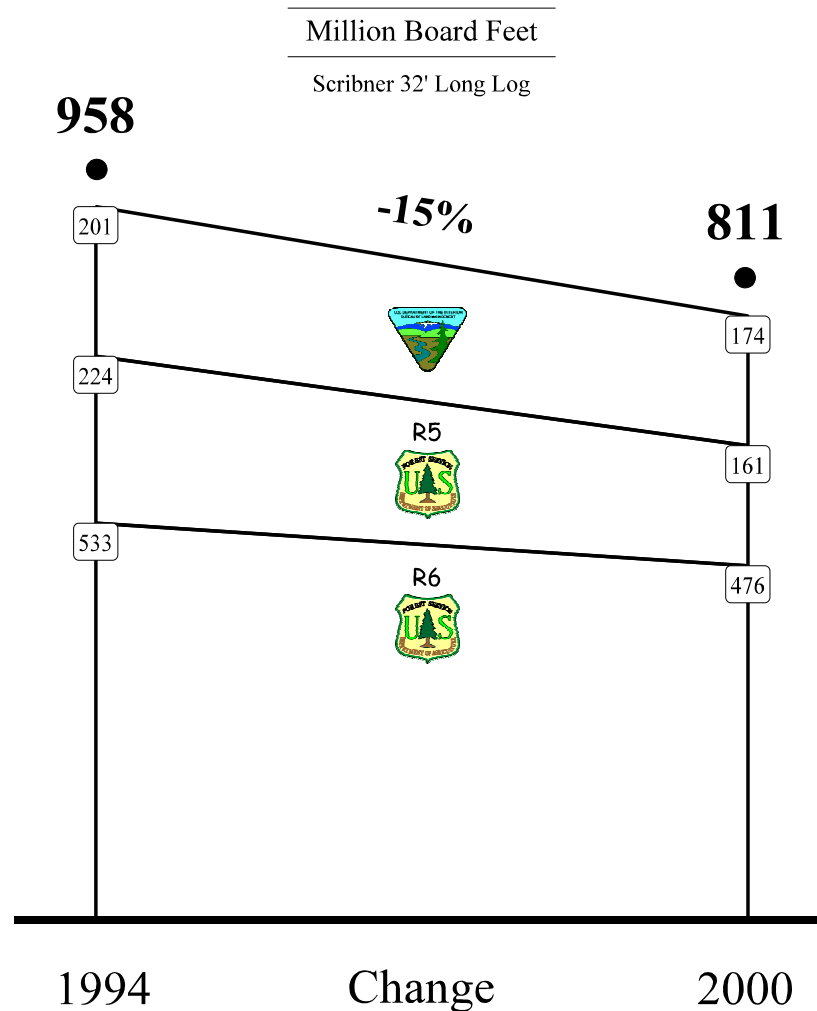
As noted in the 1994 Northwest Forest Plan Final SEIS, the PSQ is based only on those lands considered suitable for production of programmed, sustainable timber yields. These lands are only in the Matrix or Adaptive Management Area land allocations. Riparian, Late-Successional, and

other reserves do not contribute to PSQ. The 1994 Northwest Forest Plan Final SEIS estimated the PSQ at 958 million board feet (MMBF), plus an additional 10 percent volume estimated in “other wood” (cull, submerchantable, firewood, and other products) for a total of 1.1 billion board feet (USDA, USDI, 1994a, pp. 3&4-266 and 268).

### Changes From 1994 Northwest Forest Plan FSEIS to Present

The 1994 Northwest Forest Plan Final SEIS and ROD addressed the potential for the PSQ to change as National Forest and BLM District land and resource management plans were completed or revised, with the Final SEIS stating “sustainable sale estimates will be made using more refined data and procedures available when Draft Forest and District Plans are completed or current plans are revised” (USDA, USDI 1994a, p. 3&4-267). When the Northwest Forest Plan PSQ of 958 MMBF was calculated, land and resource management plans for western Oregon BLM Districts and four California National Forests were not final. Plans for these administrative units were completed in 1995. In 1998, six Oregon and Washington National Forests revised their PSQs to refine riparian reserve estimates and other calculations done for the 1994 Final SEIS. The cumulative result of these actions is a 15 percent reduction from the 1994 Northwest Forest Plan Final SEIS to a current combined PSQ for the Forest Service and BLM of 811 MMBF. This reduction in PSQ from 1994 to 2000 is shown in Figure 3&4-9. None of the PSQ adjustments were made for Survey and Manage species.

**Figure 3&4-9.** Changes in total PSQ (1994-2000) resulting from completion or correction of land and resource management plans. Year 1994 represents the PSQ displayed in the Northwest Forest Plan FSEIS. Year 2000 represents the PSQ currently declared in land and resource management plans.

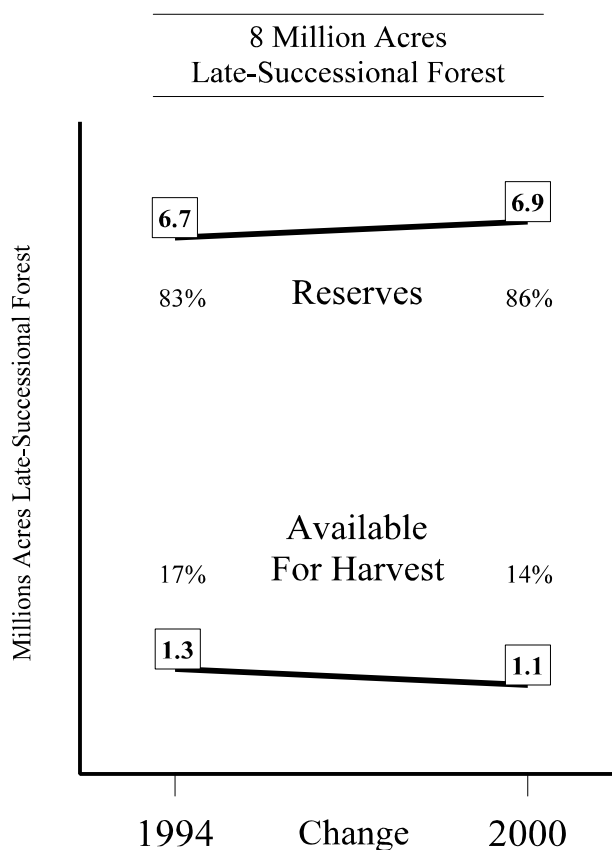


### Late-Successional Forest Acres Available for Harvest

K. Norman Johnson (Johnson et al. 1993, p. 14) reported the baseline forest seral stage data that was used in the Northwest Forest Plan Final SEIS. At that time, there was a total of 8 million acres identified as late-successional forest (medium and large conifer categories) in all land allocations on all federally managed lands in the Northwest Forest Plan area. A total of 1.3 million acres, or 17 percent of the 8 million acres of late-successional forest, was in Matrix and Adaptive Management Areas and available for harvest as part of the PSQ (Figure 3&4-10).

With the 15 percent reduction in PSQ levels from 1994 to 2000 (based primarily on increases in acres calculated to be in Riparian Reserves) it is estimated that there is a corresponding reduction in the amount of late-successional forest available for harvest. For analysis purposes, it is assumed that the 1.3 million acres available for PSQ in 1994 is now 1.1 million acres, or 14 percent, of the 8 million acres of late-successional forest. The remaining 0.2 million acres has been assigned to reserves.

**Figure 3&4-10.** Change in the amount of late-successional forest available for harvest versus the amount assigned to reserves, 1994-2000, resulting from completion or correction of land and resource management plans.



### Relationship of PSQ and Late-Successional Forest

There are approximately 3 million acres of forest land within the Matrix and Adaptive Management Areas that contribute to PSQ. Approximately one-third of this, or 1.1 million acres, are late-successional forest. On most administrative units, the PSQ is heavily dependent on harvesting late-successional forest for 3 to 5 more decades until early-successional stands begin to mature and become available for harvest. Because of this dependence, harvest schedules indicate about 90 percent of PSQ over the next decade is dependent on harvest of late-successional forest. This situation was reflected in modeling PSQ for the Northwest Forest Plan as:

*“Most of the harvest in Option 9 [the selected alternative]...over the next decade will come from late-successional (over 80 years old)...While Option 9 may reserve sizeable amount of late-successional forest on federal land, it does not escape the historic dependance on late-successional forest and old growth as the source of harvest volume...”* (Johnson et al. 1993, p. 22).

Since a majority of sites occupied by Survey and Manage species are in late-successional forests, managing species sites as described in the Survey and Manage Standards and Guidelines has the effect of reducing the amount of late-successional forest that is available for harvest. This reduction in the amount of late-successional forest available for harvest has a direct and calculable effect on PSQ.

The relationship between late-successional forests and PSQ can be quantified by comparing Alternatives 1 and 9 in the 1994 Northwest Forest Plan Final SEIS (see Table 3&4-11). Alternative 1 in the 1994 Northwest Forest Plan Final SEIS allocated all late-successional forest to reserves and calculated PSQ using only early and mid-successional forest (generally less than 80 years old). Otherwise, standards and guidelines and acreage available for PSQ were similar between the two alternatives. The difference between the PSQ for these two alternatives, therefore, approximates the amount of the PSQ from late-successional forest. The current PSQ shown on Table 3&4-11 was generated by assuming that the ratio between PSQ dependent on late-successional stands, and the PSQ dependent on early-successional stands is the same as in 1994.

Quantifying the portion of PSQ that originates from late-successional forests permits quantifying the effects of the Survey and Manage mitigation measure. Reductions to the 1.1 million acres of late-successional forest available for harvest are assumed to have a direct, proportional effect to the 714 MMBF portion of the PSQ dependent on late-successional forests. For purposes of this analysis, the 97 million board feet coming from early-successional forests is assumed to be unaffected by the Survey and Manage mitigation measure, and is held constant across all alternatives.

It is acknowledged that known sites affect harvest of early-successional forest for some species. The ISMS database used for this analysis does not distinguish between early and late-successional forest at this time. Since Survey and Manage species are, by definition, closely associated with late-successional forest, and the majority of pre-disturbance surveys and management of known sites occurs in late-successional forest, acreage effects are all assumed to occur on late-successional forest in this PSQ analysis.

<b>Table 3&amp;4-11. PSQ Contribution from Late-Successional Forests (MMBF)</b>		
<b>Alternative in the NFP FSEIS (p. 3&amp;4-268)</b>	<b>NFP FSEIS PSQ (1994)</b>	<b>PSQ Reduced by 15% (current)</b>
Alternative 9	958	811
Alternative 1	114	97
Alternative 9, late-successional portion of PSQ	<b>844</b>	<b>714</b>

## Northwest Forest Plan Assumptions on Survey and Manage and PSQ

The 1994 Northwest Forest Plan Final SEIS had little information with which to estimate magnitude or likelihood of effects of the mitigation measures on PSQ. However, this uncertainty was noted in the Northwest Forest Plan Final SEIS. A 6 MMBF reduction in PSQ was made for 1993 known sites, but the possibility of future sites was summarized as:

*“...other modifications made to Alternative 9 add to the uncertainty of the PSQ calculations. These changes include the requirement to survey and manage future sites of some late-successional forest associated species” (USDA, USDI 1994a p. 3&4-267).*

The Northwest Forest Plan Final SEIS made no PSQ adjustments for Survey and Manage sites that would be identified in the future. It was assumed that occurrences of these sites would be rare and effects on lands available for harvest would be minimal.

## Methodology Used in Analysis of PSQ

Estimating the effects to PSQ is dependent on being able to determine the number of acres of late-successional forest that will ultimately be managed as known sites for Survey and Manage species. The Agencies have now had 2 years experience conducting pre-disturbance surveys prior to habitat-disturbing activities for most of the species requiring such surveys. Approximately 8 percent of the late-successional forest in Matrix and Adaptive Management Areas has been surveyed. The number of species sites detected during these surveys was used to project the number of sites that will be located in the future. Currently there are approximately 25,000 acres of identified known sites of which 5,000 are for rare species, and 20,000 are for uncommon species (over 25,000 acres of known sites for species proposed for removal from Survey and Manage under the action alternatives are not included in this number).

At the current rate of pre-disturbance surveys it will take 25 years to survey the 1.1 million acres of late-successional forest in the Matrix and Adaptive Management Areas. For most species, predicting the eventual number of sites that might affect PSQ simply involves projecting the current known sites detection rate ahead for 25 years. Since the action alternatives contain provisions for removing species from Survey and Manage, some of the more numerous species were projected for a shorter period of time. Based on current detection rates, compared against numbers of known sites for species proposed for removal from Survey and Manage in this SEIS, projection limits were established for the 13 species which make up over 75 percent of the total acreage of currently known sites (63 species proposed for removal from Survey and Manage not included). The magnitude of actual PSQ effects for the various alternatives would vary if application of the adaptive management process and/or the identification of high-priority sites in Management Recommendations results in management of a lower or higher number of future known sites than projected.

The average number of acres managed at each site varies by taxa group and by species within the taxa groups, according to habitat requirements described in Management Recommendations for each species or taxa group. An estimate of the average site size per species, multiplied by the total number of projected sites, was used to estimate the overall effect on late-successional forest available for harvest. Additional adjustments were made to account for acreage which would become inoperable for harvest, and additional sites expected to be found with strategic and equivalent-effort surveys.

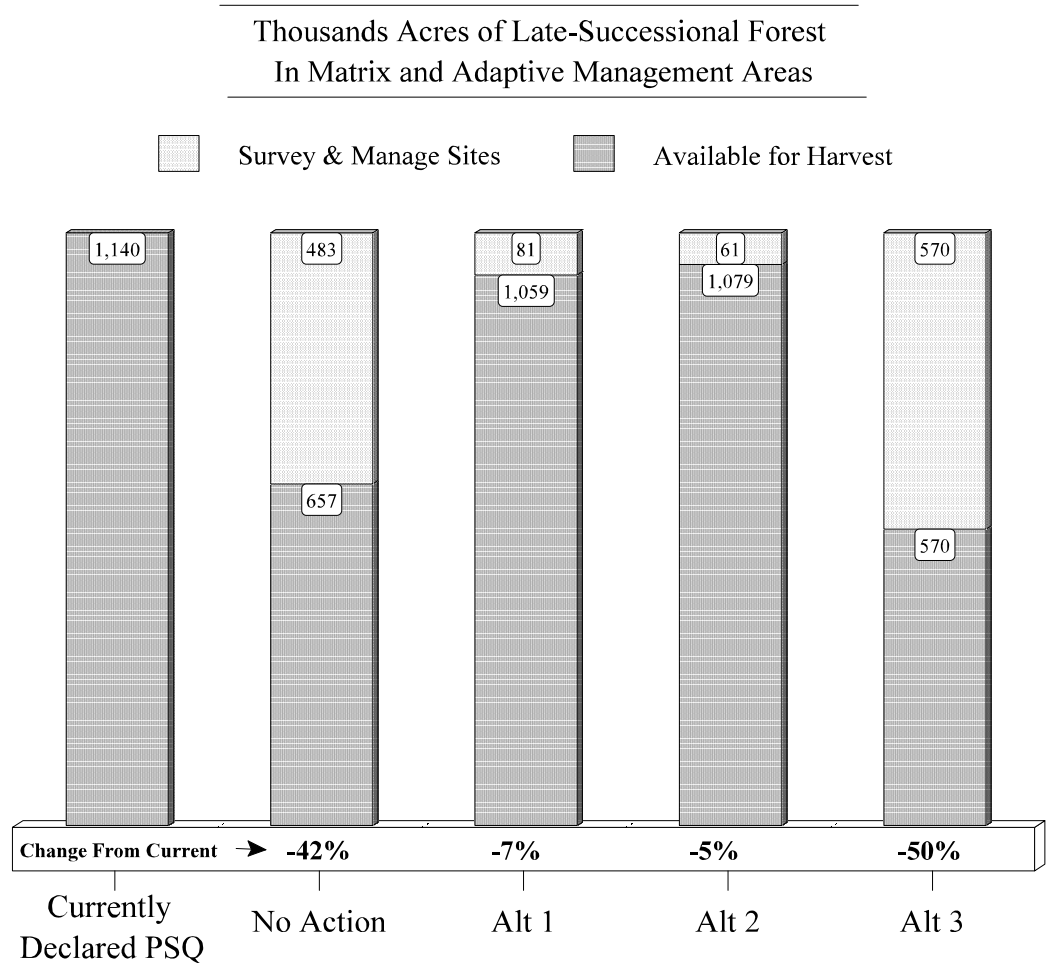
# Environmental Consequences

The number of acres of late-successional forest that may ultimately be managed as known sites for Survey and Manage species vary by alternative, depending on the number and size of sites to be managed. A summary of the acres of late-successional forest in the Matrix and Adaptive



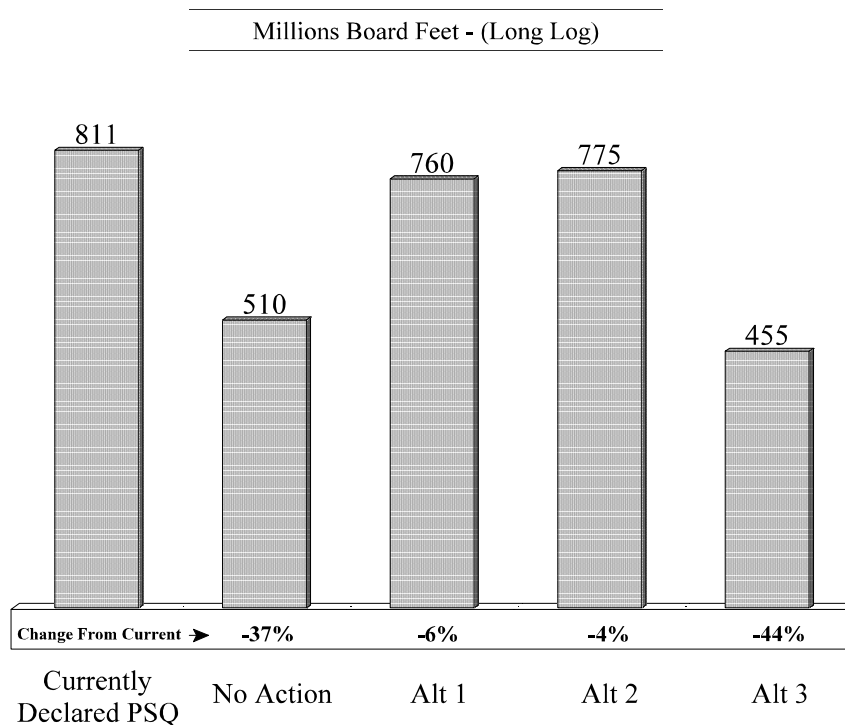
Management Areas that are projected to be managed as known sites under each alternative, and the acres remaining available for harvest is shown on Figure 3&4-11. (Additional information about the projected acreage of known sites, based on relative rarity, is shown in Figure 3&4-11.)

**Figure 3&4-11.** Projected Acres of Survey and Manage Sites Affecting PSQ, All Alternatives. The first bar represents the 1.1 million acres available for harvest for the currently declared PSQ (down 15 percent from the acres available for harvest in the 1994 Northwest Forest Plan FSEIS). The projected acreage of Survey and Manage sites affecting this 1.1 million acres of late-successional forest within the Matrix and Adaptive Management Areas is displayed in thousands for each of the alternatives.



As described above, the percent of late-successional forest projected as known sites has a corresponding effect on the late-successional forest portion of the PSQ. The No-Action Alternative projected species sites acres of 42 percent, for example, reduces the 714 MMBF of PSQ associated with late-successional forests by 42 percent to 412 MMBF. Adding this to the 97 MMBF of PSQ associated with early-successional forest (held constant for this analysis) results in a total harvest level for the No-Action Alternative of 510 MMBF. The estimated harvest levels for each alternative is shown in Figure 3&4-12.

**Figure 3&4-12. Harvest Levels -** The figure below illustrates the projected PSQ levels of the alternatives compared with the PSQ currently declared in the Agencies Land and Resource Management Plans. The 97 MMBF contribution to PSQ from non late-successional forest is held constant across the alternatives.<sup>1</sup>



<sup>1</sup>Note: The PSQ effects are based on projecting the results of 2 years of surveys for known sites ahead for 25 years, with projection limits on 13 species to simulate the adaptive management process. The analysis has been done at the planning area scale and does not consider the exact effects of the changes in the lands available for harvest at smaller scales. Effects at the administrative unit would vary from this regional-level analysis. This analysis is not intended to have the precision necessary for re-declaring PSQ for the National Forests and BLM Districts. Actual PSQ will be affected by the number of sites that are found, future adaptive management decisions, and future modifications to the Management Recommendations for the identification of high-priority sites.

(PSQ volumes are Scribner 32-foot long log measure. To convert to short log, divide PSQ by 0.825.)

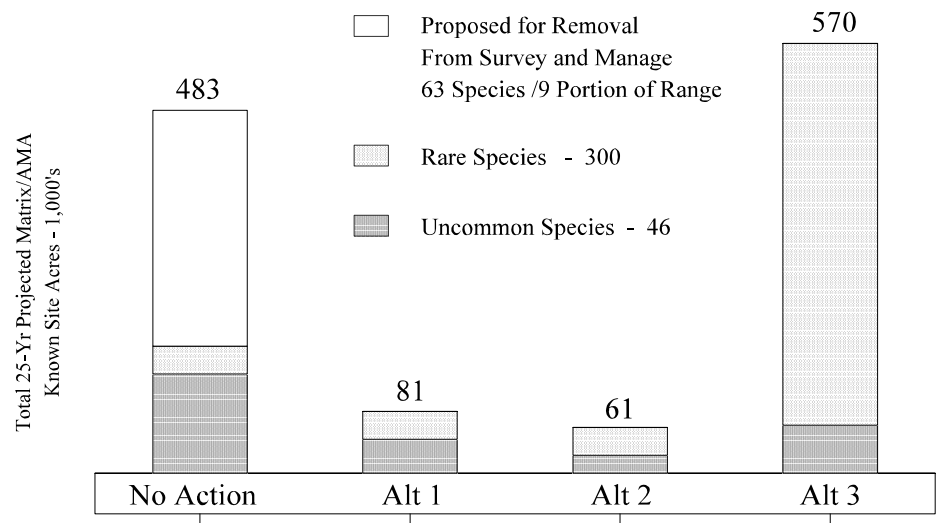
Because of differences between the alternatives based on relative rarity of species, and the proposed removal of species under the action alternatives, it is important to understand the known site projections for each of three groupings (see Figure 3&4-13). The 72 species proposed for removal from Survey and Manage in all or parts of their ranges under the action alternatives account for 65 percent of the currently known site acreage, and thus account for 65 percent of the difference in PSQ between the 811 MMBF currently declared and the 510 MMBF No-Action Alternative PSQ. For the 346 species remaining on Survey and Manage in the three action alternatives, the 46 uncommon species account for more than 75 percent of the currently known site acreage. The projected removal of some of these species from Survey and Manage in the action alternatives, and the removal of all of these species in Alternative 2, results in a substantial PSQ increase when compared with retaining these species in the No-Action Alternative.

### Assumptions and Comparison of Effects of the Alternatives

**No-Action:** The 1994 Northwest Forest Plan Final SEIS had little information with which to estimate magnitude or likelihood of effects of Survey and Manage on PSQ, other than a 6 MMBF reduction in PSQ for then-known sites. This was not unreasonable, as species included under Survey and Manage direction were expected to be rare and have relatively few sites. As described above, however, implementation experience with Survey and Manage has provided new information about known sites.

As described in the Background section of this chapter, the PSQ for the No-Action Alternative is based on an assumption of no changes to the number of species under Survey and Manage through time. It is assumed that the existing rate of identification and management of sites for all species would continue for the next 25 years, increased slightly for increases in extensive and general regional surveys. Projecting all species at current detection rates results in 483,000 acres of known sites. Fifty-eight percent, or 657,000 acres, of late-successional forest would remain available for timber harvest, with an annual harvest level of 510 MMBF. If the No-Action Alternative is selected, changes to the species managed under Survey and Manage species would likely occur over time, but the magnitude and timing of those changes is unknown.

**Figure 3&4-13.** Additional information about the projected acreage of known sites, based on relative rarity. The 25-year projection of known site acreage is subdivided to give relative context of acreage related to the species proposed for removal from Survey and Manage, and with the rare and uncommon species categories.



Achievement of PSQ in the No-Action Alternative would be delayed up to 5 years while protocols are designed and implemented for 7 species of fungi which appear to need 5 years of pre-disturbance surveys. Annual harvest during this time could be limited to the 97 MMBF that comes from non-late-successional stands, plus volume from any stands outside the range of these seven species.

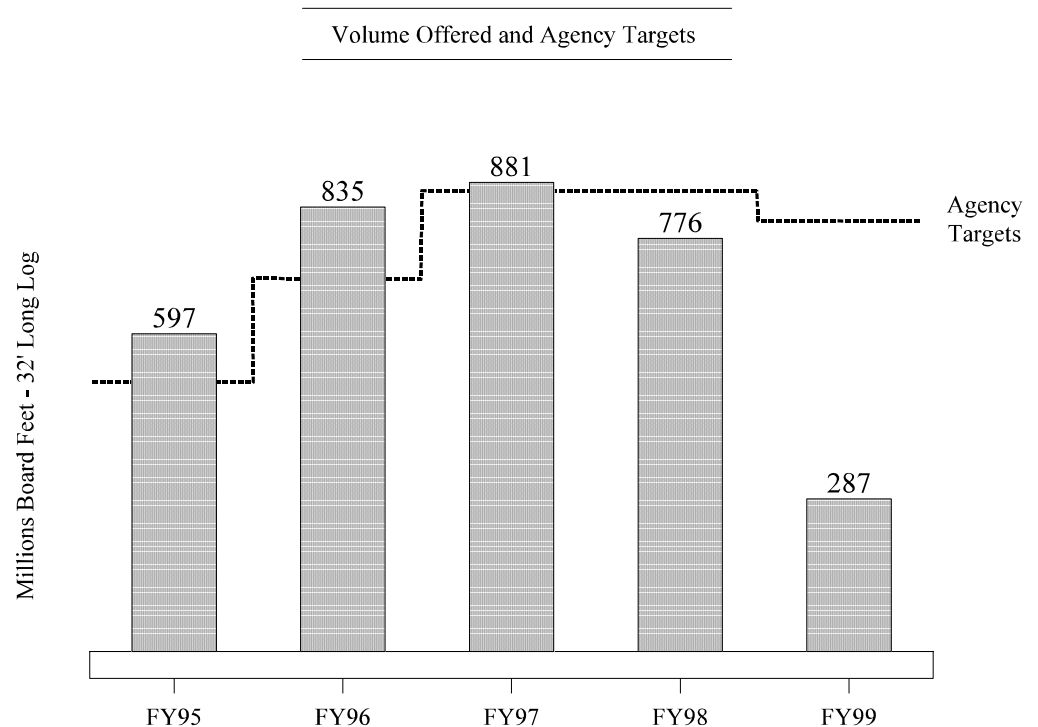
**Alternative 1:** The 63 species proposed for removal from Survey and Manage, plus 9 species proposed for removal from Survey and Manage in a portion of their range, reduces the currently known sites by 65 percent (when compared to the No-Action Alternative) and thus reduces projections that affect PSQ. Projection limits were applied to 13 other species to simulate expected removal of species from Survey and Manage in the future. The remaining 333 species, both rare and uncommon, are projected in the future to affect 81,000 acres of late-successional forest available for harvest. Ninety-three percent, or 1,059,000 acres, of late-successional forest would remain available for timber harvest, with an annual harvest level of 760 MMBF.

**Alternative 2:** Alternative 2 differs from Alternative 1 only in that the sites for 46 uncommon species are held at 1999 levels for 5 years until a decision is made regarding the need for additional management. It is assumed that after 5 years, increases in known site acreage for species included in the Agencies' special status species programs would be offset by decreases for species removed from Survey and Manage in this category. Holding the acreage of known sites for these 46 species at current levels, rather than projecting them as in Alternative 1, reduces the projected acreage of known sites by 20,000 acres to 61,000 acres. Ninety-five percent, or 1,079,000 acres, of late-successional forest would remain available for timber harvest, with an annual harvest level of 775 MMBF.

**Alternative 3:** Alternative 3 differs from Alternative 1 in two primary ways. Sites for rare species (Category 3A) have 250-meter buffers, so they are projected at 48 acres each, compared to 2 to 10 acres for most sites in Alternative 1. Second, equivalent-effort surveys, while projected to find only 20 percent of the sites found during other pre-disturbance surveys, are nevertheless applied to five times as many species as Alternative 1 (or 324 species in Alternative 3 versus 67 species in Alternative 1). Known site acreage is projected at 570,000 acres, with almost 90 percent of this coming from the rare species 48-acre sites. Fifty percent, or 570,000 acres, of late-successional forest would remain available for timber harvest, with an annual harvest level of 455 MMBF.

The provision to add species in the action alternatives adds uncertainty to PSQ projections. Provisions to add species to Survey and Manage may reduce future PSQ levels; the magnitude of that change is unknown.

**Current Situation:** The Agencies' annual timber sale offerings are shown in Figure 3&4-14. The Agencies' harvest targets were 60 and 80 percent of PSQ during the start-up years of 1995 and 1996, respectively. The PSQ was adjusted by completion of land and resource management plans in 1994 and 1995 and a recalculation of Riparian Reserve acres for six National Forests in 1998. Up until recently the annual timber sale offerings have been consistent with the PSQ predictions in the 1994 Northwest Forest Plan Final SEIS. Shortfalls in 1998 and 1999 resulted primarily from lawsuits over the implementation of the Survey and Manage standards and guidelines (see Response to August 1999 U.S. District Court Findings section in Chapter 2 of this SEIS) and over biological opinions related to certain harvests in watersheds with threatened or endangered anadromous fish stocks (Pacific Coast Federation of Fishermen, et. al., vs. National Marine Fisheries, decided 9/30/99 in U.S. District Court, Western District of Washington at Seattle.) The Survey and Manage issues are expected to be resolved with the decision notice associated with this SEIS. The anadromous fish decision has been appealed to the United States Court of Appeals for the Ninth Circuit.

**Figure 3&4-14.** Harvest Volumes Offered Under the Northwest Forest Plan, 1995-1999.

### Short-Term Effects

Harvest levels calculated in this analysis represent averages expected over the long term, based on total projections of known sites and expectations that several, somewhat numerous, species will either be removed from Survey and Manage within the next 5 to 10 years, or Management Recommendations will limit the number of sites needing management to those that are “high priority.” Completion of strategic surveys, analysis of the new information, refinement of Management Recommendations, and modifications to species assignment within Survey and Manage will all take time. Activities conducted in the next few years will need to consider more species than similar activities in later years. Implementation of timber sales in the short term will result in a higher proportion of acres being managed for Survey and Manage species than in the long term.

### Scale and Precision

The analysis of PSQ effects has been done at the planning area scale and does not consider the exact effects of the changes in the lands available for harvest at smaller scales. Effects at the administrative unit would vary from this regional-level analysis. This analysis is not intended to have the precision necessary for re-declaring the PSQ for the affected National Forests and BLM Districts. Actual PSQ will be affected by the number of sites that are found, future adaptive management decisions, and future modifications to the Management Recommendations for the identification of high-priority sites. Modifications to National Forest and BLM District level PSQ need to be based on the accumulation of specific unit-level effects during administrative unit plan revisions. At the range-wide scale, however, the PSQ effects calculated here are considered to be reasonable estimates of both the magnitude of effects, and of the differences between the alternatives.

Additional detailed information about methodology and assumptions in this analysis is included in the administrative record and is available upon request.

## **Other Environmental Consequences**

The Council on Environmental Quality (CEQ) regulations require that this discussion include “...any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented.” (40 CFR 1502.16). These topics are addressed, where relevant, as part of the discussion of environmental consequences for each component of the environment.

The short-term use or protection of natural resources for long-term sustained yield is at the legislated basis of management direction for the Forest Service and BLM. The short-term uses of resources, in accordance with the standards and guidelines for all alternatives, would result in minimum long-term loss in productivity of forest components necessary for a healthy forest environment.

Implementation of projects, in accordance with the alternatives, would result in some loss of individuals, sites, or isolated populations of species. There are no irreversible or irretrievable commitments related to species closely associated with late-successional and old-growth forests that would prevent these species from being supported, well distributed throughout their historic range on federally managed lands for at least 100 years.

In examining environmental consequences, as discussed above in relation to actions that would modify mitigation measures, it is important to understand the overall purpose of mitigation. In general, mitigation is a measure taken to cause an action to become less harsh or severe. The CEQ regulations (40 CFR 1508.20) state that mitigation includes avoiding impacts, minimizing impacts, reducing impacts, or compensating for impacts. In analyzing the consequences of alternatives that vary in the way they would implement the same basic mitigation strategy, it would be expected that impacts may be slight or that the range of consequences may be narrow.

## **Conflicts with Other Plans**

The CEQ regulations (40 CFR 1502.16) require a discussion of “possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.” This SEIS incorporates by reference the discussion in the Northwest Forest Plan Final SEIS concerning conflicts with other plans (USDA, USDI 1994a, pp. 3&4-319 and 3&4-320, and Appendix D). Modifying some mitigation measures of the Northwest Forest Plan as proposed in all action alternatives of this SEIS (see Chapter 2, Background) would not alter the conclusion of the Northwest Forest Plan Final SEIS regarding the possible conflicts with other plans.

The management direction in this SEIS applies only to federally managed lands where state and local land use plans, policies, and controls have little application. Similarly, this proposed action and the alternatives do not apply to tribal and Indian-owned lands, with one exception. The Coquille Indian Tribe currently manages approximately 5,400 acres of forest lands (Coquille Forest) under the same standards and guidelines as the adjacent federal land management agency (Coos Bay District, BLM). This places them in a unique position as the only tribe in the Northwest Forest Plan area that must comply with the Survey and Manage Standards and Guidelines.

Ten species of mollusk are identified in Alternative 1 (the Preferred Alternative) as having habitat (including known sites) insufficient to support stable populations of these species. Four of these species, *Derocerus hesperium*, *Helminthoglypta hertleini*, *Megomphix hemphilli* (south of the south boundary of Lincoln, Benton, and Linn Counties, Oregon) and *Pristoloma artium crateris* are also included on the BLM's Special Status Species Program as Bureau Sensitive species. *Derocerus hesperium* has 2 recent federal sites, *Helminthoglypta hertleini* has 6 recent federal sites, *Megomphix hemphilli* (south of the south boundary of Lincoln, Benton, and Linn Counties, Oregon) has 250-350 recent federal sites, and *Pristoloma artium crateris* has 11 recent federal sites (see Table F-2). These recent federal sites have been discovered since 1994 through pre-disturbance surveys as required by the Northwest Forest Plan Record of Decision.

Per the BLM's 6840 policy for Special Status Species, one of the Bureau's objectives for a Bureau Sensitive species is not to contribute to the need to list the species under the Endangered Species Act. The Oregon BLM's designation as Bureau Sensitive for these species is based upon a species being an Oregon Natural Heritage Program (ONHP) List 1 species. The ONHP's List 1 identifies species that the ONHP believes are taxa threatened with extinction or presumed to be extinct throughout their entire range. Adoption of Alternative 1 as the Preferred Alternative may create a conflict between the policy objective of not contributing to the need to list these four of species and management specified under Alternative 1. Based upon analysis in the environmental consequences section, other alternatives provide stable outcomes for these species.

Except for that noted above, the proposed action is construed to have an absence of conflicts with any other plans, policies, and controls.

**Table 3&4-1. Fish Species Listed (or Proposed for Listing) in the Northwest Forest Plan Area as Endangered or Threatened Under the Federal Endangered Species Act.****Species Status: Endangered***Chasmistes brevirostris* (Shortnose sucker)*Deltistes luxatus* (Lost River sucker)*Eucyclogobius newberryi* (Tidewater goby)*Oncorhynchus clarki clarki* (Umpqua River cutthroat trout) (proposed for delisting)*Oncorhynchus mykiss* (Upper Columbia River steelhead trout)*Oncorhynchus nerka* (Snake River Sockeye Salmon)*Oncorhynchus tshawytscha* (Sacramento River winter run chinook salmon)*Oncorhynchus tshawytscha* (Upper Columbia River Spring chinook salmon)*Oregonichthys* (=Hybopsis) *crameri* (Oregon chub)**Species Status: Threatened***Hypomesus transpacificus* (Delta smelt)*Oncorhynchus keta* (Columbia River chum salmon)*Oncorhynchus keta* (Hood Canal summer run chum salmon)*Oncorhynchus kisutch* (Central California coho salmon ESU)*Oncorhynchus kisutch* (Oregon Coastal coho salmon)*Oncorhynchus kisutch* (Southern Oregon/Northern California coast coho salmon)*Oncorhynchus mykiss* (California Central Valley steelhead)*Oncorhynchus mykiss* (Central California Coast steelhead)*Oncorhynchus mykiss* (Lower Columbia River steelhead)*Oncorhynchus mykiss* (Mid-Columbia River steelhead)*Oncorhynchus mykiss* (Snake River Basin steelhead)*Oncorhynchus mykiss* (Upper Willamette River steelhead)*Oncorhynchus nerka* (Ozette Lake sockeye salmon)



<b>Species Status: Threatened</b> , continued
<i>Oncorhynchus tshawytscha</i> (California Central Valley chinook salmon)
<i>Oncorhynchus tshawytscha</i> (California Coastal chinook salmon)
<i>Oncorhynchus tshawytscha</i> (Lower Columbia River chinook)
<i>Oncorhynchus tshawytscha</i> (Puget Sound chinook)
<i>Oncorhynchus tshawytscha</i> (Snake River fall run chinook salmon)
<i>Oncorhynchus tshawytscha</i> (Snake River spring/summer run chinook salmon)
<i>Oncorhynchus tshawytscha</i> (Southern Oregon/Coastal California chinook)
<i>Oncorhynchus tshawytscha</i> (Upper Willamette River chinook)
<i>Pogonichtys macrolepidotus</i> (Sacramento River split tail)
<i>Salvelinus confluentus</i> (Columbia River bull trout Distinct Population Segment)
<i>Salvelinus confluentus</i> (Klamath River bull trout Distinct Population Segment)
<b>Species Status: Proposed</b>
<i>Oncorhynchus clarki clarki</i> (Southwest Washington/Columbia River cutthroat trout)
<i>Oncorhynchus mykiss</i> (Northern California steelhead)
<i>Salvelinus confluentus</i> (Puget Sound bull trout Distinct Population Segment)

Table 3&4-2. Comparison of Categories and Management Elements for Protection Buffer and Category 2 Fungi Species.				
Species	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3
<i>Bondarzewia mesenterica</i>	Categories: 1, 2, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1B Manage known sites. Strategic surveys.	Category: 2B Manage known sites. Strategic surveys.	Category: 3A Manage known sites at 48 acres, minimum. Equivalent-effort surveys. Strategic surveys.
<i>Otidea leporina</i>	Categories: PB, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1B Manage known sites. Strategic surveys.	Category: 2B Manage known sites. Strategic surveys.	Category: 3A Manage known sites at 48 acres, minimum. Equivalent-effort surveys. Strategic surveys.
<i>Otidea smithii</i>	Categories: PB, 1, 3 Manage known sites. Pre-disturbance sites. Extensive surveys.	Category: 1B Manage known sites. Strategic surveys.	Category: 2B Manage known sites. Strategic surveys.	Category: 3A Manage known sites at 48 acres, minimum. Equivalent-effort surveys. Strategic surveys.
<i>Polyozellus multiplex</i>	Categories: PB, 1, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1B Manage known sites. Strategic surveys.	Category: 2B Manage known sites. Strategic surveys.	Category: 3A Manage known sites at 48 acres, minimum. Equivalent-effort surveys. Strategic surveys.

Table 3&4-2. Comparison of Categories and Management Elements for Protection Buffer and Category 2 Fungi Species.				
Species	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3
<i>Sowerbyella rhenana</i>	Categories: PB, 1, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1B Manage known sites. Strategic surveys.	Category: 2B Manage known sites. Strategic surveys.	Category: 3A Manage known sites at 48 acres, minimum. Equivalent-effort surveys. Strategic surveys
<i>Otidea onotica</i>	Categories: PB, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1F Strategic Surveys.	Category: 2D Manage known sites as of 9/30/99. Strategic Surveys complete in 5 years.	Category: 3C Manage known sites. Strategic Surveys.
<i>Sarcosoma mexicanum</i> , Washington, California, Curry and Josephine Counties in Oregon.	Categories: PB, 3 Manage known sites. Pre-disturbance surveys. Extensive surveys.	Category: 1F Strategic Surveys.	Category: 2C Manage known sites as of 9/30/99. Strategic Surveys complete in 5 years	Category: 3C Manage known sites. Strategic Surveys.

